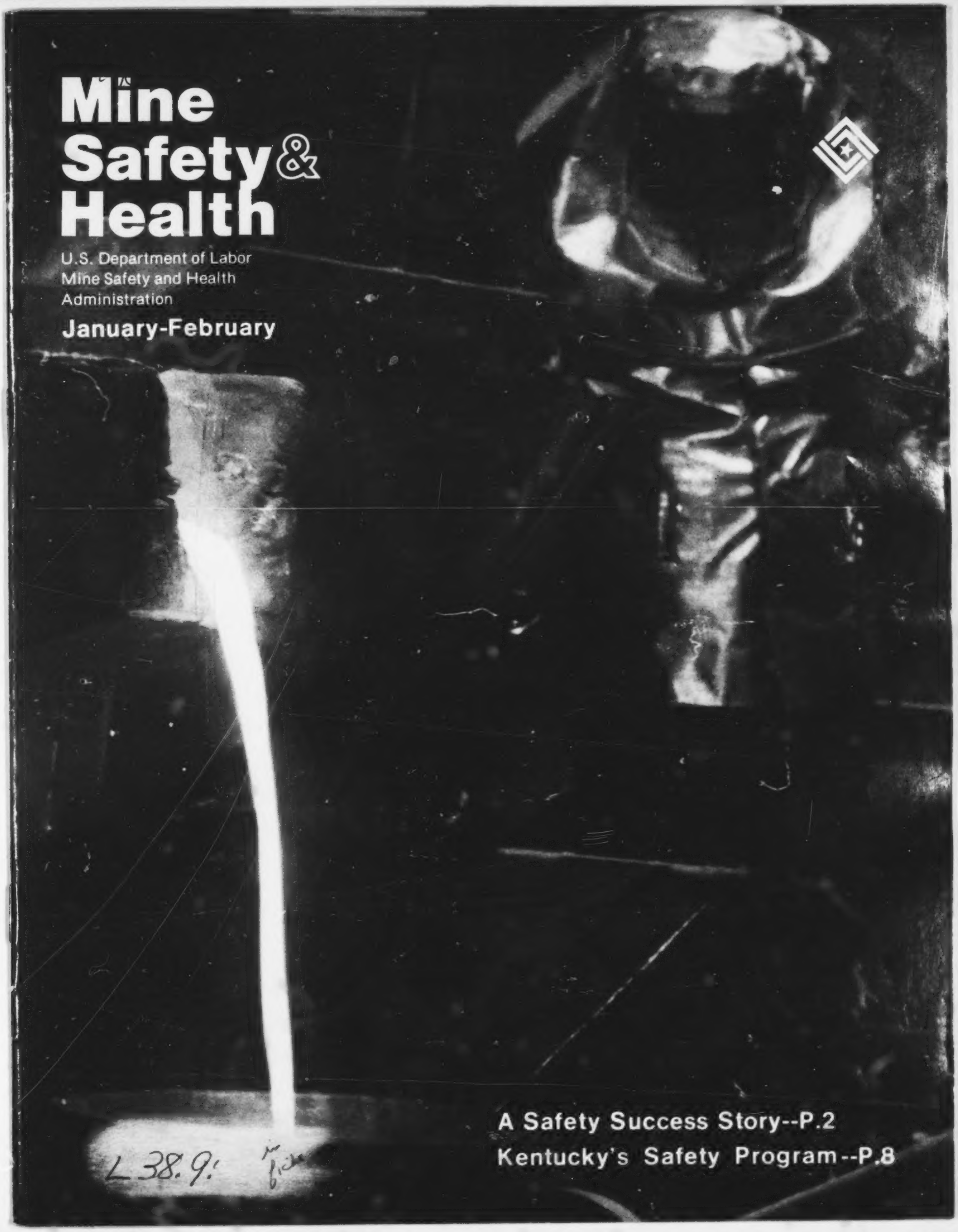

Mine Safety & Health

U.S. Department of Labor
Mine Safety and Health
Administration

January-February

A Safety Success Story--P.2
Kentucky's Safety Program--P.8

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The Importance of On-the-Spot Help for New Miners. . .

We are pleased to publish the following letter from a reader both because it is thoughtful and perceptive and because we have seldom seen this particular point of view on accident reduction expressed so clearly. The article in this magazine which Mr. Balcomb refers to dealt with the causes of fatalities in metal and nonmetal mines during 1979. Thomas J. Shepich is MSHA Metal and Nonmetal Mine Safety and Health administrator. Incidentally, comments from readers under age 25 also are welcome.—The Editor.

Dear Sir:

The excellent article "Could These Deaths Have Been Averted?" in the October-November issue, received today, refers to comments made by Thomas Shepich on "a familiar theme—the close relationship between mine workers' experience levels and accident, injury and fatality rates."

The statistics speak for themselves. It is important, however, to note that inexperienced workers are generally young workers. This frequently overlooked fact is of great significance in approaching the problem of accident reduction among inexperienced miners.

People from 18 to 25 are not only inexperienced in mining, they are inexperienced in living. Their accident rate is high in all categories, not just in mining.

New-miner training of high quality is important. More important is the on-the-spot help of understanding experienced miners in orienting new people to a strange environment and in demonstrating good work practices.

Young (inexperienced) people face many problems in finding their place in an adult world. They are extremely conscious of peer pressure. More important than their own safety is their fear of not meeting peer standards; not being "macho", or, worse, being called "chicken". As a result, safety standards tend to be viewed as things complied with only by those who don't have the guts to stand on their own.

In their off-the-job life, young people face a great many problems that can seriously affect attitudes and job safety. The importance of social and economic adjustment in the young is commonly overlooked in dealing with accident prevention. There is no question but that mental attitude is tremendously important in recognizing hazards and avoiding injury. A night spent trying to keep up with one's fellows at the bar, or, worse, frustration encountered in a male-female relationship, can set a young person up with a mental attitude the next day that invites a disaster.

There is no absolute mechanism for protecting a damned fool against himself. The only defense is for supervision to be particularly alert to the frame of mind of young workers and to take extra precautions when problems are detected. We need to be constantly reminded that the *inexperienced* miner is usually a *young* miner.

Sincerely,
Philip E. Balcomb, Manager
Mulzer Crushed Stone Co.
Tell City, Indiana

Mine Safety & Health

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January - February

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Molten silver and gold being poured in the refinery of the DeLamar Mine in Idaho during last stages of ore processing. MSHA's program in Accident Reduction at the mine is the subject of a success story starting on Page 2.

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Statistics showing a significant improvement in safety at the DeLamar Silver Mine in Idaho are discussed as part of MSHA's Program in Accident Reduction (PAR). Participating, left to right, are MSHA PAR investigators Frank Clary and John Moore and the mine's former safety director, Bob Parrish.

'PAR' Means Going an Extra Step

Cooperative Safety Effort Gets Results at Metal/Nonmetal Mines

The following article is about a Mine Safety and Health Administration accident prevention program called the Program in Accident Reduction (PAR), which was first conducted several years ago at certain metal and nonmetal mines, and, although still not widely known, has become one of MSHA's most effective tools for promoting safety in mining.

The record shows that, in the great majority of cases, the Program in Accident Reduction has helped individual metal and nonmetal mine operators to reduce injury incidence rates, often dramatically.

This has occurred because many mine managers and safety directors have gone out of their way to support PAR activities and because many PAR inspectors have gone well beyond the inspector's primary enforcement role to work cooperatively with operators, miners and union representatives to pinpoint actual causes of fatal or disabling accidents and to help management upgrade safety programs.

Today, PAR is a high-priority MSHA program. This article discusses how the program works, the philosophy behind it, and its future prospects.—The Editor.

Lyle Talbot, the resident manager of the DeLamar Silver Mine, nodded in the direction of mine inspectors John Moore and Frank Clary seated across his office.

"Our people have a lot of confidence in those two guys," he said. "That goes for both the management and the miners. I haven't heard one negative thing about the program they helped us to develop at the mine."

Talbot, a forthright man who for the most part believes that industry can handle its own problems without governmental help, was talking about the Program in Accident Reduction (PAR) and the way it was handled by MSHA inspectors Moore and Clary at the DeLamar Mine in southwestern Idaho near the Oregon border. With others in management, Talbot had some misgivings about the program at the outset. But he became a strong supporter of the philosophy of the program and the activities of the MSHA PAR team.

Such support by management is crucial to the success of any mine safety effort. It is especially important in an activity like PAR, which puts a premium on cooperation, rather than an adversary relationship, among company officials, Government representatives and workers and their representatives at a mine.

The DeLamar Mine produces both silver and gold. There are no veins or nuggets at the site because the area has been intermittently mined and combed for the more obvious "finds" ever since prospectors first struck gold in nearby Jordan Creek, Idaho, in 1863. Instead, what remains is an unusual form of disseminated silver locked in tiny particles within soft clay and hard, siliceous volcanic rock which lends itself to the open pit, multiple bench method of mining used at DeLamar, rather than underground recovery.

Each ton of ore blasted loose at DeLamar contains only 3½ troy ounces of silver and less than one twenty-fifth of an ounce of gold, but the value of the two metals at the mine is substantial because of soaring world prices. Silver and gold are extracted from pulverized rock through a lime-cyanide leaching process. About 150 persons are employed at the mine and mill on three shifts seven days a week.

> *At some mining operations chosen for PAR attention, company officials are cool or outright hostile at pre-investigation briefings. At DeLamar, the management, if not wildly enthusiastic about what was to come, was patient and understanding . . .*

The DeLamar Silver Mine began operation in early 1977 with a workforce made up largely of residents of surrounding Idaho and Oregon farming and ranching communities. Many had little or no experience in modern mining methods. Some new miners traveled as far as 180 miles to and from work each day in the beginning because adequate housing was not then available near the mine. One hardy miner, rather than commute a long distance, spent a winter living under a tree shielded by plywood slabs. The relative isolation of the mine was a factor in the high rate of turnover of mine and mill employees during some months of 1977 and 1978.

During its first year of operation, the DeLamar Mine had two fatalities. In July 1977, an electrician was electrocuted while troubleshooting a lighting circuit. And in November 1977, a mill laborer died in a conveyor accident when he was caught in a takeup pulley. That year, the incidence rate for fatal injuries and nonfatal injuries with lost work days at DeLamar was 9.09 injuries per 200,000 employee hours worked.

In 1978, Lyle Talbot took over as resident manager at the mine. That Spring, the mine's safety director who also was security chief suffered a heart attack and later retired, leaving the safety department without effective full-time leadership. In the Fall of 1978, Larry Buter, DeLamar's refinery superintendent who had a good mine safety background, became acting safety director with full responsibility and authority to carry out safety policy and administer the mine's safety program.

SAFETY IS THE FIRST
PRIORITY OF EVERYONE
THE PLANT HAS OPERATED SINCE 1477
THE MILL HAS WORKED 123 DAYS
THE MINE HAS WORKED 123 DAYS
WITHOUT A LOST TIME ACCIDENT

Top management at the DeLamar Silver Mine has distributed to all employees a clear-cut statement of safety policy and the assignment of safety responsibilities, and has made sure that safety awareness is a daily concern at the mine. The sign posted at a central location is part of this effort.

The DeLamar Silver Mine in a remote area of Idaho near the Oregon border, showing the pit area, right center, the milling and refinery complex, upper left, and the tailings impoundment at upper right.

The full-time appointment of Buter to the safety post pending the hiring of an outside safety professional was, one MSHA official later said, "evidence to me that the mine's management was serious about safety concerns . . . They took a key superintendent and made him responsible for safety for as long as it would take to bring in a new safety director."

Progress was made in developing a new safety program at the mine. Actions were taken to improve accident prevention awareness and emergency medical training. The company alo issued a safety handbook for employees covering responsibilities of the different management levels and the mine and mill workers in identifying and dealing with specific mine hazards.

READEX FICHE

A crew prepares to blast loose rock containing gold and silver ore in the DeLamar Mine pit area. One safety recommendation made to the company by MSHA investigators concerned the need to improve highwall scaling methods.

Material containing silver and gold ore is loaded onto trucks to be taken to the mill at the DeLamar Mine. The MSHA survey team found that the company had an excellent maintenance program for trucks and other equipment.

The former farm and ranch hands learned mine production skills well from veteran company management personnel. Having done little or no mining previously, many of the new workers also had to learn mine safety awareness and safety procedures virtually from the beginning. Meanwhile, continuing high employee turnover rates hampered efforts to achieve training continuity and develop a seasoned workforce. In one month, September 1978, the turnover rate was 19 percent of the total mine workers and 16 percent of the total mill workers at that time.

Although there were no deaths at the DeLamar Mine in 1978, the incidence rate for injuries in which work days were lost rose from 9.09 the previous year to 13.76 injuries per 200,000 hours worked—a rate higher than the incidence rate for this type of mine nationally during 1978.

At this point, MSHA's Program in Accident Reduction (PAR) had been in effect for four years at selected metal and nonmetal mines throughout the country. From the start, the program had been based on several general premises. One is that only a small percentage of the Nation's 15,000 metal and nonmetal mines account for half or more of the disabling/lost-worktime injuries year after year, and it makes sense to focus accident prevention efforts on those operations.

Another concept underlying PAR is that it takes more than routine inspections to assure compliance with Federal regulations to achieve significant reductions in accidents and injuries; in carrying out PAR activities, MSHA complements its enforcement role under the Federal Mine Safety and Health Act of 1977 by actively assisting companies in evaluating their safety efforts and strengthening safety policies, programs and personnel relationships that bring about a decrease in injuries.

A third premise is that the more people at a mine who understand the safety program and become involved in it the greater chance of success the program will have. As outside safety professionals, PAR inspectors are in a good position to encourage such involvement by all parties at a mine.

Based on its 1978 safety record compared to the national norm for similar type mines, the DeLamar Silver Mine was one of 60 metal and nonmetal mines designated for special attention under PAR during 1979. It should be pointed out, however, that, well before the mine was placed on the PAR list, the management had asked for and been given special help from MSHA in dealing with safety problems.

Inspectors Clary and Moore, who work out of the Bellevue subdistrict office, MSHA Metal and Nonmetal Mine Safety and Health, in Boise, outlined purposes and goals of PAR for William Cole, a vice president of Earth Resources Co., majority owner of the mine, and Larry Buter, the acting safety director, in early March 1979. At that time, Lyle Talbot was out of town.

The PAR inspectors brought along "workups" they had made, using accident reports and data supplied by MSHA's Health and Safety Analysis Center (HSAC) in Denver, showing the breakdown of accidents at the mine by type, place of occurrence, day of the week, occupational category and other factors. They had made the workups to see if they could spot trends.

Nearly 18 percent of the workforce suffered an injury during 1978, though most injuries were minor, the company officials were told. Among the other purely statistical findings: The total injuries reported at the DeLamar Mine averaged 16 days of lost time per injury. Fifty percent of the injured were under age 27. Sixty-four percent of the injuries occurred on Fridays and Saturdays. More than three out of four injuries occurred at the mill. Two-thirds of the injuries in 1978 involved either material handling or slips and falls. More than a third of all injuries involved the foot, ankle or knee.

At some mining operations chosen for PAR attention, company officials are cool or outright hostile at pre-investigation briefings. At DeLamar, the management, if not wildly enthusiastic about what was to come, was patient and understanding. Clary and Moore told company officials that they wanted to interview as many people as they could about DeLamar's safety policies and procedures, starting with top management and continuing to the newest laborers. Cole said he had no objections. Among other topics, those at the conference discussed the two fatalities at the mine in 1977.

Moore and Clary spent a total of two weeks interviewing between March 5 and March 23, 1979, and, Moore said, "We would like to have had longer." The team also audited the mine's accident reporting and recordkeeping system to confirm that data used to select the mine for PAR attention was valid. Lyle Talbot was present the second week.

"When we came to start our survey we got an impression of reluctance on management's part," said John Moore. "Then we went out in the field and started talking to supervisory people and, of course, top management got feedback from them immediately on what we were doing.

"I think we showed them fairly early that we were sincere in our approach and in what we had told them—that we weren't trying to pry into their corporate affairs or trying to close down their operation . . . we were sincere in trying to help them solve their problem which was a high incidence of injuries."

He added, "You have to lay to rest a fairly common misconception. Some operators think PAR is some kind of punishment for having too many injuries. But this certainly isn't punitive. That's the furthest thing from the PAR philosophy.

> *"I felt we had a real good closeout conference with the top people at the mine. We presented our findings and recommendations. Everybody took part in the open discussion. It was very informal, but we felt we were getting into the nitty gritty of the problems at this particular mine . . .*

"DeLamar's management got the feedback from our interviews at all levels. And after the second day, they told us, 'Go to it. Talk to anyone you want to at any time. Feel free. Do your thing . . .'"

A closeout conference with the mine management was scheduled at the Boise Convention Center—"on neutral ground."

"John and I found ourselves totally involved in this project," said Frank Clary. "We were excited because the company was giving us good cooperation and we came to believe that PAR could really make a difference at this mine. Some days we worked up to 18 hours getting our notes and recommendations ready for the conference." Aiding and advising them was Homer "Bud" Trussell, supervisory mining engineer who directs activities at the Boise field office.

Joe MacGuffie, assistant superintendent for mill maintenance at the DeLamar Mine, center, discusses safety concerns with, left, John Moore, and, right, Frank Clary, of MSHA. MacGuffie believes that safety and production are closely linked, and he is known for his quick response in correcting any hazardous situation which is brought to his attention.

To Trussell and the seven mine inspectors at the field office, the commitment to safety is much more than a nice-sounding phrase. The staff includes former miners who knew many victims of the Sunshine Mine fire which killed 91 near Kellogg, Idaho, in 1972, and have had close friends or relatives killed and injured in rock bursts and other accidents. One inspector, Jack Heier, was a miner at Sunshine on the shift just before the one during which the fatal fire occurred.

"I felt we had a real good closeout conference with the top people at the DeLamar Mine," John Moore said. "We presented our findings and recommendations. Everybody took part in the open discussion. It was very informal, but we felt we were getting into the nitty gritty of the problems at this particular mine."

The PAR report and recommendations noted that the DeLamar management had demonstrated that it was sincerely interested in safety and had made good progress in developing its safety program in the months preceding the PAR team's arrival at the mine.

"The DeLamar Silver Mine is to be commended on its approach to the maintenance of safe working conditions," the report said. "Noteworthy was their housekeeping in the mill under extremely adverse conditions of Spring thaw, frozen water supply lines, muddy roads and inclement weather."

The PAR team's investigation showed that, in the mill, where the conveyor death had occurred in 1977, "the mechanical guarding . . . was excellent."

Among other positive findings by the survey team:

- Preventive maintenance was performed regularly on haul trucks and the ball mills;
- Safety suggestions reaching the general mill superintendent were promptly acted upon;
- Personal protective equipment was readily available to employees;
- Emergency procedures were well established at the cyanide solution reclaim tailings pond;
- A safety management training course for supervisors was established. Also, safety meetings for employees were being conducted;
- Under the direction of Lyle Talbot and Larry Buter, accident and injury reporting and data recording methods

Lyle Talbot, resident manager of the DeLamar Silver Mine, gave strong support to MSHA's Program in Accident Reduction (PAR) at his mine.

had been improved and company accident investigations were being documented thoroughly;

- First aid training had improved, and qualified medical technicians were available for emergencies, including cases of cyanide poisoning.

Getting into the "nitty gritty of problems" at the mine during the closeout conference meant talking about both the good things the company was doing to promote safety and what—from MSHA's viewpoint—remained weaknesses in DeLamar's safety activities. The discussion was lively, but reasonable. The MSHA team emphasized that it was there to provide the company with a fresh viewpoint on safety and that the team's conclusions and recommendations were meant to be constructive. The company agreed with some findings in the MSHA survey and disagreed with others, but were receptive to suggested changes throughout the conference.

The PAR team gave the DeLamar management a big plus for issuing a readable, up-to-date employee safety manual, but pointed out that the manual did not contain a firm declaration of safety policy or stated commitment to safety by the company. The report added that employees were "unaware that any goals or objectives had been established for safety." MSHA recommended that top management issue a strong safety policy statement and set specific safety goals.

Moore and Clary concluded from numerous interviews and observation that "communications were poor at all levels" and management was getting "sketchy" feedback about safety matters from lower levels. Among other conclusions:

- Senior staff meetings were not being held and standard operating procedures had not been put into effect. Also, although accountability standards had been developed for senior staff managers, there were none for front-line supervisors;
- Company safety inspections were not always well planned or structured;
- Safety statistics and analyses of accident and injury data were not being used in safety meetings or distributed to key persons in the operation;
- Employees were not adequately recognized for good safety performances or contributions to the safety program. The environment during safety meetings observed by the team was not conducive to making effective safety presentations.

The PAR team found that, during 1978, there had been an unusually high number of chemical burns to workers' feet or lower legs. They also pointed out ways of reducing potential hazards on haul roads and controlling unstable sections of high pit walls.

In April 1979, Bob Parrish, a veteran safety professional, became director of safety and environment of the DeLamar Silver Mine. Before returning to other duties, Larry Buter, the acting safety director, spent several weeks acquainting Parrish with personnel and conditions at the mine as well as the outcome of the PAR investigation to date.

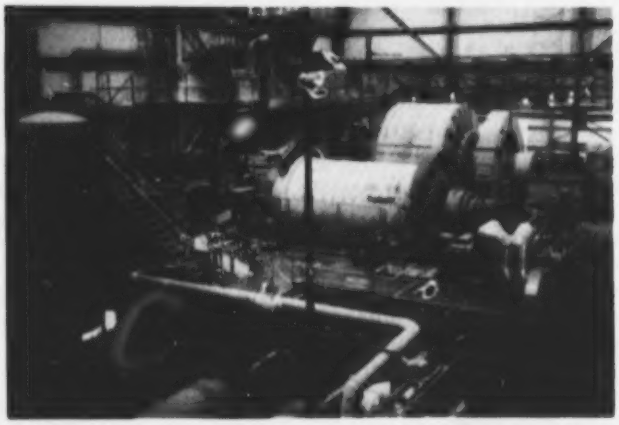
Parrish enthusiastically set about to complete improvements in the safety program begun by his predecessor and to make other innovations either recommended by the PAR team or developed on his own initiative.

Throughout 1979, the MSHA inspectors made monthly followup surveys of the mine, reporting periodically on the improving safety picture.

Management began holding senior staff meetings weekly. Regular meetings were held by the mill staff to establish standard operating procedures throughout the mill area. Efforts were made to reduce distractions at employee safety meetings, and visual aids increasingly were used to get the safety message across. Management safety responsibilities and accountability were clarified. A more formal training program was begun for both new and experienced employees.

The PAR team had recommended improvements in the company's safety inspections. The company established a regular format for inspections by a staff supervisor, the safety director, and the mine's safety committee; made findings available to employees; and established specific followup procedures to assure that unsafe situations were corrected.

(Continued on Page 26)



Part of the DeLamar Silver Mine's mill and refinery complex. Ore goes through a primary crusher, then is further pulverized in huge rotating drums containing steel balls before going through the leaching process leading to smelting in the refinery.

THE PROGRAM IN ACCIDENT REDUCTION [PAR] FOR METAL AND NONMETAL MINES, FY 1976 THROUGH 1979

FY 1976 PROGRAM

	33 operations in PAR program			All other U.S. metal and nonmetal mines and mills		
	FY 1975	FY 1976	Percent change	FY 1975	FY 1976	Percent change
Fatalities	15	5	-67%	108	108	0
Disabling injuries[1]	1772	1290	-27%	6772	7308	+8%
Fatalities per million employee hours	0.49	0.17	-65%	0.28	0.26	-7%
Disabling injuries per million employee-hours	57.58	44.76	-22%	17.42	17.61	+1%

FY 1977 PROGRAM

	48 operations in PAR program			All other U.S. metal and nonmetal mines and mills		
	1976	1977	Percent change	1976	1977	Percent change
Fatalities	8	7	-12%	105	127	+21%
Disabling Injuries	1818	1183	-35%	6780	7609	+12%
Fatalities per million employee-hours	0.23	0.22	-4%	0.26	0.31	+19%
Disabling injuries per million employee-hours	52.19	36.89	-29%	16.57	18.33	+11%

1978 PROGRAM

	64 operations in PAR program			All other U.S. metal and nonmetal mines and mills		
	1977	1978[2]	Percent change	1977	1978	Percent change
Fatalities	15	5	-67%	119	131	+10%
Lost-day injuries (NFDL)[3]	1880	1698	-10%	8150	9729	+19%
Fatalities per 200,000 employee-hours	0.10	0.03	-70%	0.06	0.06	0
Lost-day injuries per 200,000 employee-hours	12.31	10.49	-15%	3.91[5]	4.66	+19%

1979 PROGRAM

	60 operations in PAR program			All other U.S. metal and nonmetal mines and mills		
	1978[2]	1979[6]	Percent change	1978[2]	1979[6]	Percent change
Fatalities	8	5	-37%	128	117	-9%
Lost-day injuries (NFDL)	2269	1896	-16%	9158	10883	+19%
Fatlities per 200,000 employee-hours	0.05	0.03	-40%	0.06	0.05	-17%
Lost-day injuries per 200,000 employee-hours	15.24	11.82	-22%	4.07	4.50	+11%

NA = Not available

[1] Defined as injuries that caused one or more days' absence from work, including fatalities.

[2] Preliminary figures.

[3] Under a revised injury classification system, adopted in 1978, nonfatal injuries are classified as Nonfatal occurrences with Days lost (NFDL) and No Days Lost (NDL). The NFDL is not equivalent to the former category of disabling injuries (see footnote 1) because it includes cases where a miner was assigned to light duty for one or more shifts. The 1977 injuries at program operations were re-evaluated according to the new classification. However, the 1977 injuries for the rest of the metal and nonmetal mines and mills were not re-evaluated; the figure of 8150 lost-day injuries shown is estimated, based on proportion of injuries assigned to light duty work in 1978.

[4] A base of 200,000 employee-hours for injury rates was adopted in 1978.

[5] Computed from the estimated number of lost-day injuries.

[6] Projected data, based on January-September 1979 figures.

Clay Ashton, a mining hydraulics and mechanics instructor, reviews the inner workings of a hydraulic pump with students at the Madisonville, Ky., State Vocational-Technical School. Mine safety training is part of the state's massive vocational educational program which uses Federal-state matching funds.

Mine Safety Analysis and Training Programs Have Impact in Kentucky

For many Kentucky coal miners and mine operators, there was good reason to be optimistic in early 1970. Coal markets were improving, Congress had recently passed landmark mine safety and health legislation, and union reforms appeared forthcoming. By the year's end, Kentucky surface and underground mines had yielded over 125 million tons, a record for the Nation's leading coal producing state. Even so, the statistics were no consolation to the relatives and friends of 89 coal miners who died on the job that year, including 38 miners who were killed in a Dec. 30 explosion at the Finley Coal Co.'s underground mine near Hyden.

Over the next few years, injury and fatality rates began to drop as Federal enforcement efforts took hold. Then, in March 1976, explosions rocked the Scotia Coal Co.'s Oven Fork complex, killing 26 persons. Late that month, the governor appointed a special Deep Mining Safety Commission to evaluate existing state mine safety statutes, and by December, Kentucky's General Assembly had passed legislation which created a new mine safety analysis program and toughened miner training requirements.

"Scotia really pulled a lot of people together in this state," said Larry Hoffman, director of the Division of Mine Safety Analysis, Kentucky Dept. of Mines and Minerals. "Sometimes old feelings die slowly, but I think most people realize now that we have to get away from the image that Kentucky coal is bloody coal. After all, our very survival depends on it."

Separate from the state's regular mine safety inspection division under the same agency, the analysis program was one of several measures originally recommended by the Deep Mining Safety Commission, a 15-member group composed of labor, industry, state and Federal officials.

Released in October 1976, the commission's final report suggested that, although mine safety efforts over the years had focused heavily on controlling physical conditions in the mines, little attention had been given to the human factor. MSHA's Accident Prevention Program had been successful where applied, the report noted, and it concluded that an extensive state-wide job safety analysis effort could make a dramatic difference.

Lack of miner training programs across the state had also contributed to high injury and fatality rates in several instances, the 1976 report said. Though some mine operators had established effective training programs and many had taken advantage of the state's community college and vocational school facilities, the commission found, "these were the exceptions, not the rule."

Some commissioners believed that the inability of many small mine operators to afford training programs coupled with the shortage of instructors and training materials were the main reasons why only one in six Kentucky miners had received any training as of 1975. About 90 percent of the roughly 1,500 underground coal mines in the state employed fewer than 25 people, and these operations, they discovered, employed only 30 percent of the work force, but accounted for nearly 40 percent of the fatalities from 1971 through 1975. By mine size, the highest fatality rate for the same period occurred in mines employing from 101 to 200 people. With only 12 percent of the labor force, these operations suffered about 19 percent of the fatalities.

". . . We're not there to be punitive, and once we let an operator know we are there to help, not to hinder, we've already got a lot of the problem licked . . ."

Upgraded training regulations and an expanded state-wide miner training program appeared to be one answer, the commission said. On-site evaluation of miners' work habits seemed to be the other. Meeting in the December 1976 special session, members of Kentucky's General Assembly agreed and adopted the commission's proposed legislative package with only minor changes.

From the beginning, Hoffman's mission was clear. "The commission strongly believes that behavior modification and labor force motivation offer unlimited potential," the report said. The words are sweet music to his ears.

"We're in the business of selling safety, and these days, that requires a human relations effort more than anything else. I suppose you could say quite a lot of this program is really opinion-oriented, based on my own personal safety philosophy," Hoffman said. It is a philosophy rooted in his own experience as a miner.

Hoffman, 32, was working in a St. Charles, Ky., underground mine in 1969 when a blasting mishap sparked a change in his own thinking. "We had a guy substituting for our regular shot-firer one day, and I guess he thought he had everybody cleared out when he wired up the shot-box," he said. Though knocked several feet down a nearby entry in the same section, Hoffman, badly burned, somehow crawled to safety.

Nine operations later, including several for plastic surgery, Hoffman bears few scars. "I suppose it's easy enough to blame management right off," he said, "but most fatalities are due, in part, to human error. Some mine operators ask me how they can motivate their people to be safer, but it's the wrong approach," he added. "Miners will motivate themselves, a supervisor just has to provide the right working atmosphere."

Today Hoffman supervises 73 mine safety analysts, many of them retired, disabled miners, all of them assigned to their respective hometown areas. They have all had at least five years of underground experience, two of those in Kentucky, and instructor certification in both mine rescue and first-aid, among other basic requirements for analysts and regular mine inspectors. Once they have passed a rigorous three-day examination for the state's mine inspector's certificate, they undergo a six-week training program designed by their chief.

Two weeks are devoted to electrical instruction since many miners "aren't too familiar with electrical systems," Hoffman said, and other sections deal with the standard topics of state and Federal requirements, and production and training methods. The rest of the course appears to be based on Norman Vincent Peale self-improvement concepts—an inspirational guide designed to enhance listening, human relations, leadership, decision making, and, of course, motivation.

"We're not here to be punitive, and once we let an operator know we are there to help, not to hinder, we've already got a lot of the problem licked," Hoffman said.

"I believe the approach is paying off. You'd be surprised to see how fast violations get cleaned up."

An analyst's inspection powers are considered secondary to the task of "observing and evaluating work habits," Kentucky law states. And though analysts are required to check basic mine conditions, most of their day is spent on working sections with miners and crew supervisors. "We're not there to specifically hunt for little violations," Hoffman said, "but if we find them, we'll give an operator enough time to clean them up. We rarely have to issue notices." In 1978, only 60 closure orders were issued by analysts.

". . . They may have had to prove themselves, but the men and everybody accepted them pretty quick. I think it points out that a safety man has to be a sort of public relations man these days . . ."

Four factors are considered when mines are selected for observation—the operation's accident history, experience of the work force, physical conditions of the mine, and mine size. For the most part, Hoffman has zeroed in on smaller operations, and he believes his efforts are paying off. In 1978, the first year the analyst program was organized on a large scale, the all-injury incidence rate for all Kentucky coal miners was 7.74 per 200,000 employee hours, three points lower than the year before. The rate for the first six months of 1979 dropped slightly to 7.04.

Other figures aren't as encouraging. About 55 percent of Kentucky underground coal fatalities in 1979 involved falls of roof and rib, and the victims of these had an average of about eight years mining experience. "Part of

Top photo--Jack Ford, principal of the Madisonville State Vocational-Technical School, inspects a face area of a simulated training mine. The "drill holes" actually are long iron pipes which extend through the outer wall (bottom photo) and can be filled and refilled with grout as prospective miners use them to practice drilling and explosives loading methods. Holes extended through the sheet metal "top" are used for roofbolting practice.

the problem, I believe, is that people get too comfortable with the law, get too confident, think that enforcement alone will solve everything," Hoffman said. "I also agree with the General Assembly's statement that the American 'zeal for work' causes people to take chances."

"We've got a ways to go, but I think we have really helped the small mines quite a bit," he added. "The little guy often doesn't have the money to support a sizeable safety or engineering staff for one thing. Times have changed, too. Used to be the small fellow would dig just out of the side of a hill. These days they have to go a lot farther underground, and a lot of these people just don't have the experience to engineer that kind of operation."

Among other things, analysts have been called on to assist in developing ventilation and haulage systems, roof control plans, equipment modifications, and a host of other areas that affect underground safety. "We're really more like consultants than inspectors," Hoffman said.

Dave Johnson, safety director for Kaneb Services, Inc. near London, Ky., supervises a small staff of two safety inspectors responsible for checking conditions at the company's three one-section mines and two other slightly larger underground operations. "When these fellows (the state analysts) first came to the mines . . . wearing their blue hats and suits, we had no idea who they were," Johnson said. "We were really skeptical.

". . . Vocational training will revolutionize mine management in this state, and I can already see it happening at our operations . . . It's given a lot of young people, talented people, a lot of new hope in this area, and it's fostered a great feeling of cooperation . . ."

"First off, they didn't come out just to drink coffee, and we couldn't believe they'd come underground and work with us and the men all day. They even came over at night on their own time and held mine rescue classes. They may have had to prove themselves, but the men and everybody accepted them pretty quick. I think it points out that a safety man has to be a sort of public relations man these days."

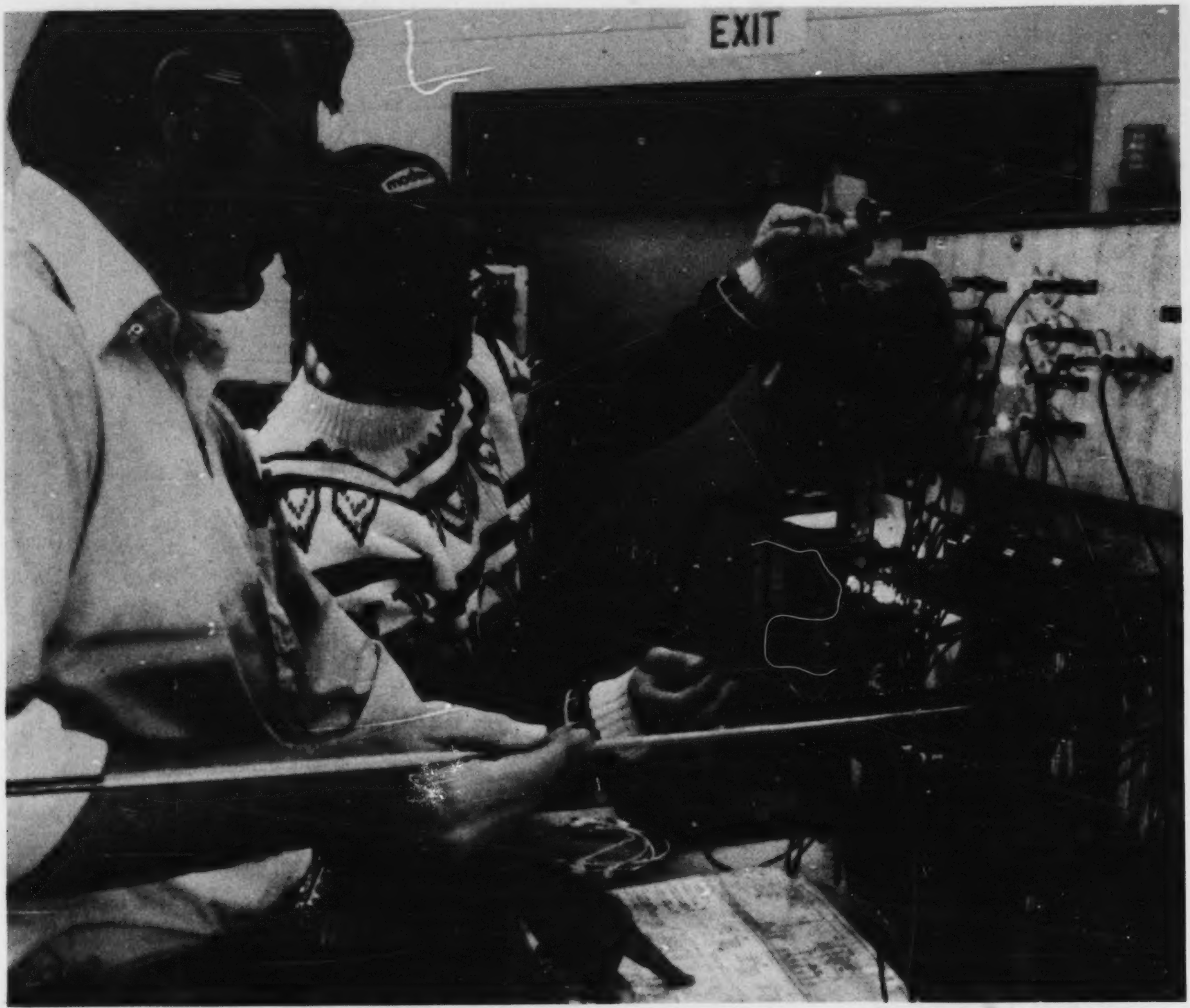
Jim Daniels, safety director for the Cal-Glo Mining Co., Williamsburg, Ky., agrees. "They discuss problems directly with miners, and they've given us a lot of technical assistance too," he said. "To be honest, I think we need both programs, enforcement along with the analysts' help. The analysts are not punitive though, and they concentrate on problems that are most likely to cause injuries rather than the administrative problems that are only indirectly related to safety."

In other areas, small underground coal mine operators in Kentucky appear to be benefiting from the state's massive education and training effort. Established in 1971, the Training and Education division of the Dept. of Mines and Minerals was the first recipient of Federal state grant funds authorized under the 1969 Coal Mine Health and Safety Act. In fiscal year 1979, Kentucky was awarded a little over $1 million, money funneled mostly into community colleges and vocational school facilities equipped to provide required miner training courses in the state's major coal producing regions.

Larry Hoffman, director of Kentucky's Division of Mine Safety Analysis. "We're in the business of selling safety . . ."

Though the state requires slightly longer courses than does MSHA, the training criteria are basically the same. Under state statutes effected in November 1978, a month after MSHA training rules became final, Kentucky underground coal and clay miners must receive a minimum of 48 hours of pre-employment training which includes, like MSHA regulations, eight hours of "mine specifics" instruction. All underground miners must receive a minimum of 16 hours annual refresher training and at least 20 hours for certain new work assignments including those involving the operation of mobile equipment, blasting and drilling operations, rail haulage and conveyor operations, and roof control operations. Any required training program, whether conducted by a company, vocational school, or others, must be approved by the state under their guidelines and approved by MSHA as satisfying the criteria under Part 48, Title 30, Code of Federal Regulations.

"There's probably not a vocational training facility more than 25 miles from any mine in the state," said Lynn Tackett, mine safety training coordinator for the state's Bureau of Vocational Education. Tackett oversees the Bureau's mine safety training programs in Harlan, Madisonville, Owensboro, Hazard and Paintsville, all major coal producing centers. Each area is assigned a teacher coordinator responsible for scheduling classes in accordance with industry needs, and overall the program employs about 85 part-time instructors, many of them disabled retirees, company and union officials.



Instructor Homer Piercy gives a step-by-step explanation of a shuttle car's electrical system to student Joel Johnson. The Madisonville Vocational-Technical School houses a number of mine equipment electrical systems identical to those used in mines throughout the Western Kentucky area.

Financed on a matching funds basis with 80 percent from MSHA and 20 percent from the state, the program includes courses for pre-employment, refresher and new task training; mine rescue, first aid, and emergency medical technician training, and training for certified and qualified personnel under both state and Federal requirements. Though Kentucky has no surface mine personnel training requirements, surface mine training classes are held that satisfy MSHA regulations.

From October 1976 through September 1979, 573 of these classes involving 10,992 participants have been held. Of those who received pre-employment training under the program, not one has ever been tallied in the annual state fatality figures, Lynn Tackett said. "It would be unrealistic to say that training alone will prevent all accidents, but it's pretty evident we've made quite an impact so far," he added.

Like Tackett and many others involved in the vocational training mine safety programs, Maurice Garrett, a teaching coordinator based in Madisonville, is highly enthusiastic. Garrett, a disabled miner, estimates that about 65 to 70 percent of the students who receive pre-employment training are hired by area companies each year. "Industry likes to take the fellows who score pretty well in the classes, and many mine operators tell me these graduates seem to do a lot better than in the old days when they'd hire a raw recruit," Garrett said.

In addition to the miner safety training classes, the Madisonville Vocational-Technical School offers a two-year course entitled "Mine Maintenance and Equipment Operation." Initially developed by the Island Creek Coal Co. in 1971, the four-phase program is now taught by three instructors to 60 students in the school's separate miner training building.

The first section of the course, general mining, includes mine safety training, mining methods and principles, use of flame safety lamps, methanometers and other safety

Students apply first-aid treatment to the "victim" of a broken leg during an Emergency Medical Technician class at the Madisonville vocational center.

equipment, and actual equipment operation training on shuttle cars, loading machines, roof bolters and other equipment borrowed from local mining companies. Mine electricity is taught at the school's electrical lab where students practice skills on a variety of systems removed from the guts of mobile mining equipment. And to round out the program, students undergo extensive instruction in hydraulic systems and general maintenance.

In the past, weather conditions have often hampered equipment operation training on a small gravel yard just outside the classrooms, but within a few weeks, students will have the chance to try out the state's first simulated mine. Recently completed, the 500,000, four section structure is constructed mostly of concrete block with a 56-inch-high steel plate roof and 20-foot-wide entries—a design built to resemble area mining conditions. "Drill holes" extended from the face of each section and from the roof by means of long iron pipes will be filled with grout—later to be drilled and re-drilled by students practicing on equipment inside. The mine will be licensed by the state and MSHA, will undergo regular unannounced inspections, and is expected to be used for district mine rescue contests.

A second simulated mine in Hazard is due for completion in March 1980; construction of a third which will also include nearby classroom facilities is due to begin in Harlan in June 1980; and a fourth is planned for Paintsville late this year.

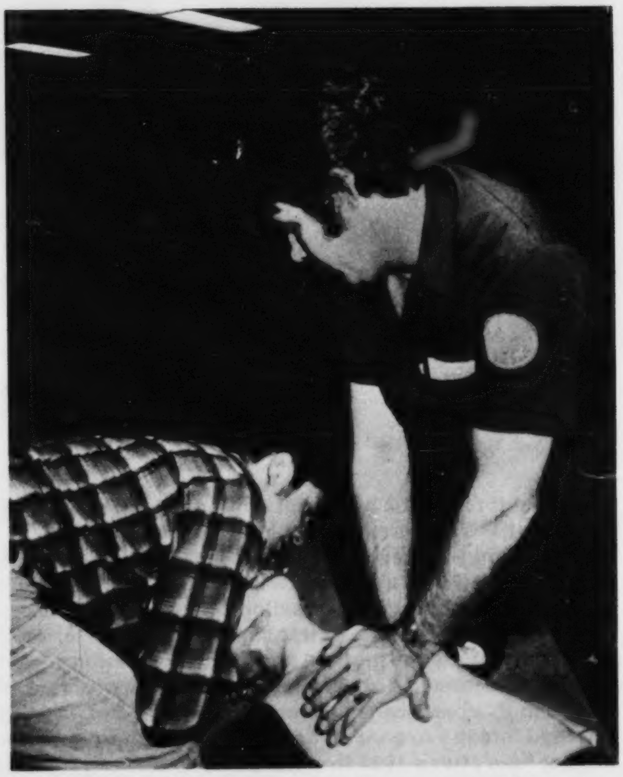
John H. Gray, director of Human Resources for Island Creek Coal Co. in Madisonville, and a key figure in the development of the vocational school's two-year mining program, is among many area officials who apparently hold high expectations for the future.

"Vocational training will revolutionize mine management in this state, and I can already see it happening at our operations," he said. "Every man will be a technician . . . and it will upgrade the people we already have. For one thing, it's given a lot of young people, talented people, a lot of new hope in this area, and it's really fostered a great feeling of cooperation among everybody here, . . . the miners, industry, state and Federal people. . . ."

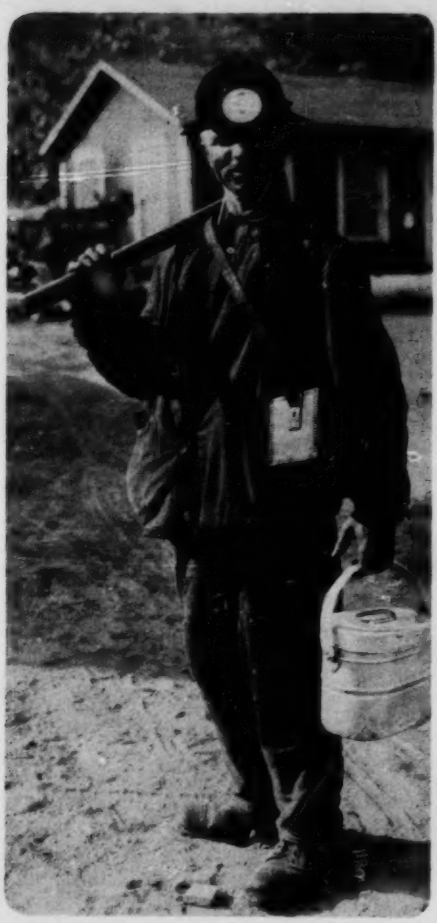
Madisonville Vocational-Technical School facilities are currently being used for several classes of a Mining Technology program offered by nearby Madisonville Community College. Geared to place graduates in industry management levels, the 64 to 67-hour program includes instruction in geology, graphics, surveying, electricity, first-aid, EMT training, hydraulics, coal preparation, management, and mine safety among many others. After completion of the first semester, students are eligible to participate in a cooperative work-study education program, working in local mining operations while receiving part-time instruction at the college. Graduates of the program receive an associate degree in mine technology, and to date, many have found employment with area mining companies, manufacturers, state inspection agencies and MSHA.

Plans are currently underway to establish a four-year degree program, and Madisonville Community College officials are working with others at Murray State University to develop the curriculum.

Charles Head, a longtime Kentucky UMWA official who served on the Deep Mining Safety Commission, shares John Gray's feelings that Kentucky coal miners have much to be hopeful about as the new decade begins. "There's a little trend toward honesty now, and though there's always doubt and shadow boxing, people can work out problems when they face the hard facts," Head said. "We still got a ways to go, but I think we're really on the move."

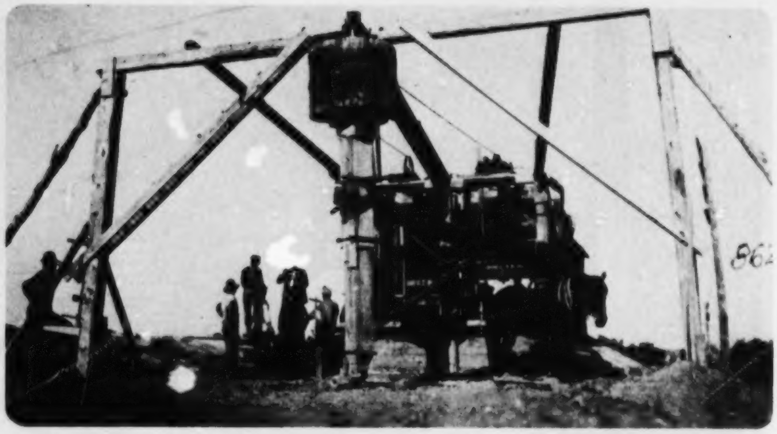


A course in Cardiopulmonary Resuscitation is included in curriculum at the Madisonville vocational center. Here, an instructor and student practice on a dummy victim.



A Backward Look...

Woven through the history of mining in the United States are the stories of a resilient and resourceful people whose contributions to the Nation's industrial wellbeing cannot be overestimated. The photos on these pages depict miners of another era at work. Shown are: (1) a Pennsylvania coal miner with pick, "dinner bucket" and blasting cap box in 1924; (2) an early coal mine company town; (3) rescuers use canaries to check for oxygen-deficient air after a 1911 methane ignition at a Tennessee underground coal mine; (4) the hardrock miner's rubber hat is standard equipment for working in wet stopes in this past scene; (5) rescue crewmen wearing breathing devices descend into the Argonaut metal mine in California to sample the mine atmosphere after a 1922 fire that killed 47 miners; (6) workmen sift gold mine tailings through a rocker at a western operation as the mine owner watches; (7) dredge is used to recover gold in the early 1920s; (8) a horse hoist slowly raises coal out of a slope mine operation; (9) a Spanish, horse-operated "arrastre" finely grinds high-grade ore, after which it is panned for gold.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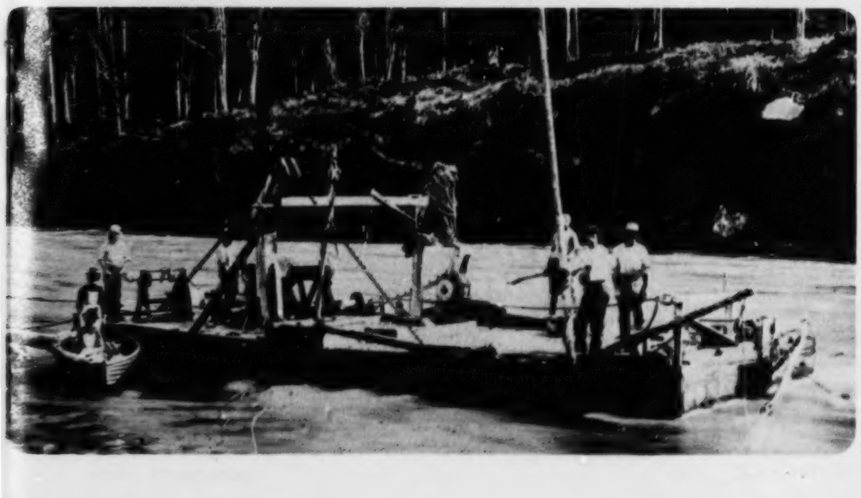
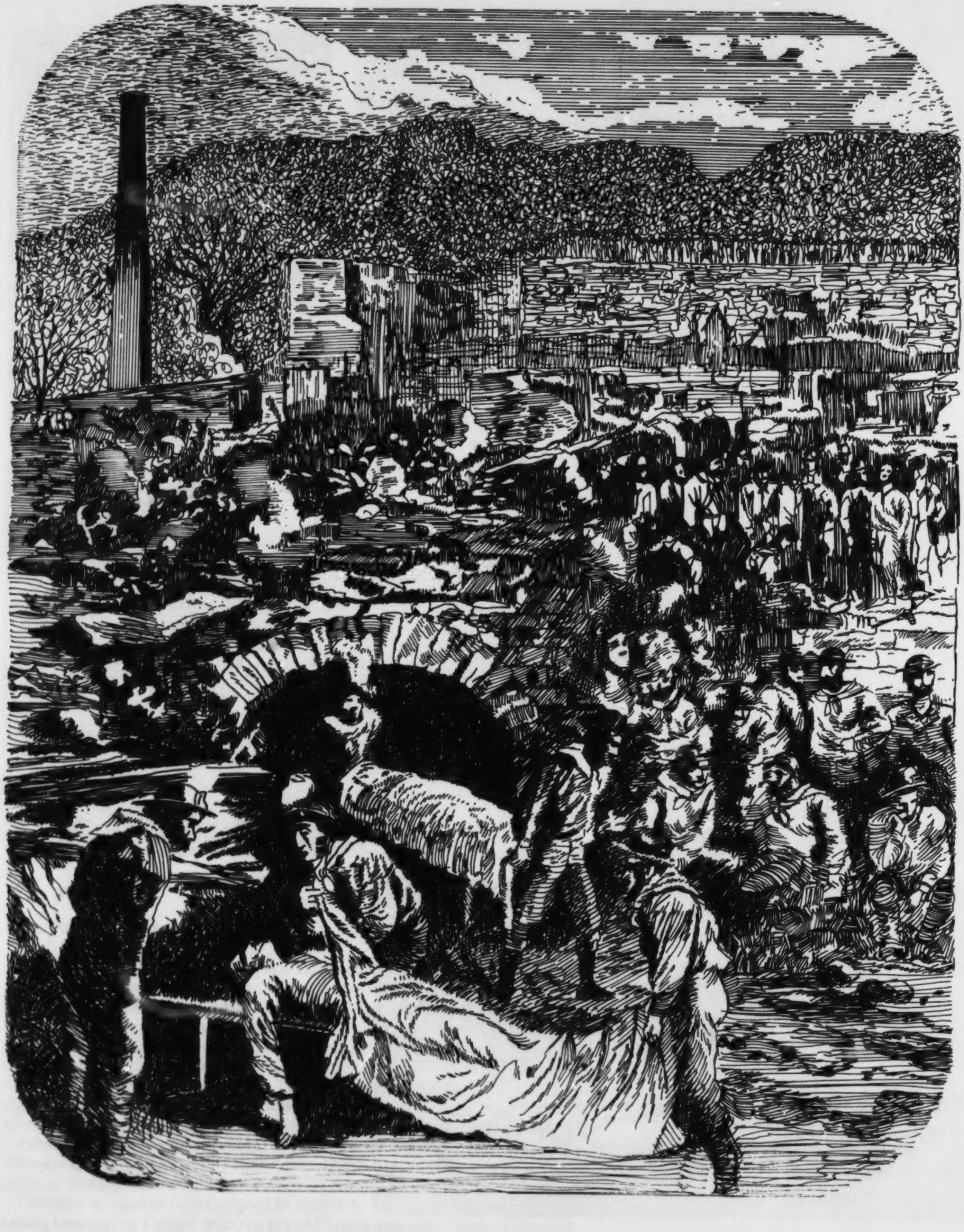




For 110, the 'Fine' Avondale Mine Was a Tomb...

By Sandra Campbell
MSHA Staff Writer

At 11 a.m. on Monday, Sept. 6, 1869, the hoisting engineer at Pennsylvania's Avondale mine heard an explosion. Turning, he saw flames shooting up the shaft and rushing to the wooden works on top. Instinctively, he blew the colliery whistle, warning the town that the mine was afire and that the men working below were trapped.

In seconds, everything combustible about the entire works was in flames. From the coal-crushing breaker straddling the shaft on top to the Bloomsburg Railroad track ties below, from nearby hills to the banks of the Susquehanna River, all was ablaze.

Located in the Wyoming Valley of Luzerne County in the heart of Pennsylvania's anthracite region, the Avondale Colliery represented the best and worst of American coal mining in the late 19th Century. The shaft, engine house and breaker were solidly built, the machinery new, and the daily production record of 700 tons of coal enviable.

Like most mines in the area, however, Avondale had critical flaws. Though considered 'the finest in the valley,' the mine was ventilated by furnace, built of wooden works, and had only one opening. Completed three years before, it operated under a lease with the Delaware, Lackawanna, and Western Railroad Co., an arrangement which freed the company from responsibility for the shortcomings in Avondale's construction.

Because there was little public interest in mining conditions and no protective legislation at the time, as well as active opposition to change from the mining companies, Avondale's miners had little hope of improving their lot. Many of the 168 men underground that September morning in 1869 were recent immigrants from the mining communities of Germany, England, Scotland and Wales. In England and Germany, safety laws had been passed and working conditions were generally superior to those in the United States. Low wages and sporadic employment, however, had forced many to come to America, leaving their families behind in the old country. Their efforts to have ventilation and inspection laws passed had repeatedly failed, for the immigrant miners were no match for the well-funded and organized coal mine companies.

For the friends, relatives and neighbors of the trapped miners, the enormous column of smoke and fire issuing from the burning shaft became a beacon.

A journalist described the gathering at the shaft in the emotion-charged reporting style of the day:

". . . But there was another phase of the scene at this time which harrowed up the very soul. Surrounding the fire on every side were hundreds of men, women, and children, the female portion of whom were making the air resound with their frantic cries of distress. Wives were wringing their hands and wailing "Oh! my Jimmy;" "God have mercy;" "Who'll take care of my children?" and using every expression of endearment and of woe. Mothers were crying out for their sons, as only mothers can cry, and feeling only as mothers can feel. Fathers were bewailing the loss of their first born or the son of their later years: Brothers and sisters were mourning the loss of brothers, and sweethearts were frantic over the immolation of fond lovers. . . . No persuasion, entreaty, advice, or consolation served to quiet them."

As they watched, the fire spread up the nearby hills, kindling trees and threatening miners' houses. Occupants hurriedly removed their household possessions and rejoined the crowd, which by noon numbered in the thousands.

Avondale had been considered 'safe' and had no firefighting equipment so bucket brigades were formed by bystanders to pass pails of water to firefighters near the mouth of the shaft. Meanwhile, cables for help were sent to fire departments of nearby towns. Two hours passed before three steam engines arrived: the 'Good Will No. 1' of Wilkes-Barre, the 'Luzerne' from Kingston, and the 'Nay Aug' from Scranton. Each was accompanied by a contingent of men and supplied with water from a stream below the railroad and a tank positioned on a hill above the mine. Water was pumped into the chutes of burning coal, over the breaker and head house, and down the shaft.

An unused, debris-filled tunnel, which connected with the shaft 30 feet below the surface, was cleared and used

as another conduit for water. By midafternoon, most of the fire was extinguished and preparations began to send groups of rescuers down the shaft.

The shaft was blocked with smoking debris, and it took several hours to clear the entrance and erect a horse-powered derrick and hoisting apparatus. At 6 p.m., a small dog in a slatted wooden box and a lighted lantern were lowered into the shaft to test the air.

Those at the surface waited anxiously. When the box was raised 10 minutes later, the lantern had been extinguished, but the dog was alive. Buoyed by hope that the miners trapped below might also be alive, relatives and friends excitedly shouted down the mine shaft, but there was no response to their echoing cries.

Realizing that time could be critical, leaders of the hastily organized rescue attempt decided that someone should go down the shaft. Of the many volunteers who stepped forward, Charles Vartue, a strong, young miner from a neighboring colliery, was selected for the first descent. Hooking on his lamp, Vartue wound a wet towel around his neck, grabbed a lantern, canteen of coffee, and signal rope, and climbed into the hoist bucket to be lowered into the shaft. Fourteen minutes later he returned, reporting that his descent had been obstructed halfway down by debris, but that the air was good and not too hot. With two men and the proper tools, Vartue said, the descent could be made.

Deciding it best to send two fresh men, Charles Jones and Stephen Evans were selected and supplied with hatchet, hook and other equipment to clear their passage. In nine minutes, they reached the bottom and climbed out of the bucket. A tug on the rope several minutes later signaled those at the top to hoist the men back to the surface. Gasping for air, they emerged from the shaft with a discouraging report.

> *". . . It seems idle to peril life by any further attempts to go down as long as the gas is so strong . . . there really is no ground to hope that a single life remains of those who went to work in the mine Monday morning . . ."*

They had pushed 70 or 80 yards into a gangway blocked by a closed door. Hoping the trapped miners had barricaded themselves behind the door, the two men pounded, waiting for some response or sign of life. There was none. Exhausted and afraid of being overpowered by sulfurous smoke pouring from crevices in the woodwork, the men decided to return to the surface before attempting to break down the door.

Two miners from neighboring coal towns, Thomas Williams and David Jones, were lowered next in the bucket with picks, shovels and a determination to find their missing comrades. Those at the top heard the clank of tools as the two men climbed out of the bucket and stumped down the gangway. Then there was nothing.

After a long wait and no signal tug, a search party descended and found the volunteers lying unconscious on the mine floor, overcome by oxygen-deficient blackdamp. Quickly they were hoisted to the surface where bystanders tried, but failed, to revive them. They were the first known fatalities of the Avondale disaster.

It was now past midnight and it had become obvious that, until fresh air could be forced into the mine, further rescue attempts would be suicide. At the mouth of the shaft, the men reluctantly agreed to wait until morning when a fan and donkey engine would arrive from Scranton to flush the poisonous air from the mine. A terse cable was flashed over the Nation's wires:

"The only hope for the men in the mine is their having shut themselves out entirely from the draft."

At dawn Tuesday morning, people gathered silently around the shaft to renew the vigil. Someone began a collection to help the families of the trapped men. A meeting of miners was convened in the nearby woods to select 50 experienced men to continue the search. The fan and donkey engine arrived, and ventilation procedures were started.

The 50 men from Plymouth and Pittston, Nanticoke and Taylorville, Coalville and other surrounding coal towns took turns going down the shaft, clearing debris and pushing deeper into the mine. Each carried a burning oil lamp which would flicker low or go out if blackdamp were encountered. As each new passageway was cleared, the men extended a large canvas air conveyor to flush it out. Still, the air was foul, and each team returned to the surface in worse condition than the preceding one. By noon the men were too overcome to continue, and another cable tapped out the worsening situation to the country:

". . . It seems idle to peril life by any further attempts to go down as long as the gas is so strong. No attempt can, of course, be made to reach the main door or penetrate the mine until the outer gangway is cleared of gas. There is really no ground to hope that a single life remains of those who went to work in the mine Monday morning. Everybody gives them up and naught probably remains to do but unearth the dead. . . ."

For the next two hours, nothing could be done except force air down the shaft. Then relays of four men, lamps in hand, lowered themselves into the mine to begin the ritual again. Although the air was now less foul and much of the debris had been cleared away, one of the relays made a disheartening discovery. The furnace area was full of burning coal. Early reports had insisted that this coal had been drawn out and extinguished on the first alarm of fire.

Rescue efforts had been based on this false assumption, and the implications of the mistake swept over the men. The canvas ventilation conveyor carried below ground earlier had forced air into the mine all day through the gangway in which the furnace stood, carrying all the gas and smoke into the inner recesses of the mine. This alone would have killed every one of the missing miners, if any had still been alive Tuesday morning.

At the surface, plans were made to deal with this disastrous development. A water hose was dropped down the shaft, and relays of miners formed to thread the hose through the gangways and to the furnace. This became a long and tortuous job. The gas, smoke and heat were intense, and the gangways were filled with obstructions. Team after team descended and returned, sick and exhausted. It took six teams six hours just to place the hose in position for the water.

> *Among the rescuers, there were no novices. Each man sent below was an experienced miner and no stranger to tragedy. Each knew the likely fate of the trapped miners, and few held out hope. Fires, explosions, roof falls and gas had taken a regular toll of relatives and friends from all who lived in the area . . .*

Because the furnace was shielded on all sides, the men had decided to angle the water against the roof over the furnace. This rapid cooling of the rock by the water caused the roof to crack and fall. In an unusual turn of luck, no one was hurt, and by midnight Tuesday the fire was out.

If the fire had been extinguished, so had any hope that there would be survivors underground. In the early hours of the third day, the weary volunteers prepared for a final attempt to penetrate the smoking passageways that could only result in the recovery of bodies.

Among the rescuers, there were no novices. Each man sent below was an experienced miner and no stranger to tragedy. Each knew the likely fate of the trapped miners, and few still held out hope. Fires, explosions, roof falls and gas had taken a regular toll of relatives and friends from all who lived in the area. But when the search party reached the closed brattice which the miners had hastily built to shut themselves off from the foul air, each man quietly steeled himself for what lay ahead.

H. W. Chase, city editor of the Scranton Morning Republican, described the scene as the rescuers broke through the brattice:

"Grouped together, in every possible position, laid the dead bodies of 67 men and boys, some appearing as if they had quietly dropped asleep, while others seemed to have struggled with their impending fate. Some of these latter laid with their faces buried in coal dust on the floor, in the vain attempt to find a current of fresh air. Others' hands were clasped to their throats, while not a few had their faces wrapped in their shirts. One father, Mr. Williams R. Evans, was stretched out, with a son closely clasped by each arm, while a third was lying between his legs, with his head resting on his father's breast. Another father, Mr. Hutton, lovingly embraced a young son, and all appeared as if sweetly sleeping."

Over the next two days, 41 more bodies were recovered, bringing the total dead to 110, including the two volunteers who died in the rescue attempt. A hastily-convened jury was impaneled to view the remains as they were brought out of the mine. The descriptions of the dead in the Morning Republican were graphic, as the following few examples show:

"William Powell, of Plymouth (Turkey Hill). Eyes both open, and head turned to one side. Wife and several children in the old country. One daughter lives in Plymouth, and one son is dead in the mine.

"John Davies, Plymouth, formerly of Pittston; son of John R. Davis, previously brought out; mouth and face bloody and ghastly; commenced to work at Avondale on Monday.

"Willie Hatton, about ten years old. His father is down in the mine dead; Plymouth (Turkey Hill). Face pale; looks as though sleeping. It is said that this little fellow did not work in the mine, but that his father took him in with him the fatal morning, according to a promise made him some time previously.

"Madison Alabaugh, Avondale. Mouth open; blood oozing from nose. Wife and three children—oldest seven years of age. It was said that this man had told his wife that if an accident ever occurred to the mine, he would be found living, as he knew just where to go for safety. His wife clung to the hope which this promise gave her, to the last, insisting all the time that Madison was all right."

When the last gangway, breast, cross-cut, airway and mine car had been thoroughly searched, one more foray was made into the mine. Benjamin Hughes remembered that his brother, Evan, had carried a diary in his coat pocket, and that the coat was missing when the body was carried to the surface. Hoping to find some record of the final hours, he returned to the east gangway with four men.

They found the coat 500 feet from where the body had been discovered, with a compass and the diary in the pocket. Apparently, Evan had dropped the coat while running to help the men erect a barricade. When he realized their situation was hopeless, it had been too late to make a final entry in his diary. The story would have to be pieced together by others.

For the wives and children of men like Evan Hughes, bereavement was compounded by the problem of survival. Avondale left nearly 300 destitute widows and orphans in this country and many in the old country as well.

Because the magnitude of the disaster attracted such complete press coverage, however, funds from across the Nation poured in. The $700 collected from those gathered at the shaft on Tuesday formed the nucleus of a fund which by the end of the month reached $144,825. On Sept. 10, a Board of Trustees was appointed to devise a distribution system "to provide not merely for present necessities but also to anticipate the future welfare of orphan children." Each widow was given a yearly stipend until her death or remarriage; each orphan was given the same until the age of majority. At that time, the trustees declared, children of the miners would be provided with a sum which "with prudence will enable them to make a better start in life than was the case with most of their unfortunate fathers." The remainder of the money was to be wisely invested, providing a permanent trust fund for those who lost husbands, fathers, sons and brothers.

With the establishment of the relief fund, attention focused on the disaster itself. Why did it happen? Who was responsible? How could such a tragedy be prevented in the future? A coroner's inquest began Saturday, Sept. 11, and sought to answer these questions. Miners, members of the search parties, company representatives, and medical experts testified and were cross-examined.

Several points were repeatedly made: that sparks from the furnace started the fire; that the miners were not instantly killed; that they would have lived long enough to save themselves if there had been any other outlet; that despite frequent warnings about the danger inherent in single-shaft, furnace-ventilated mines, most mines in Pennsylvania's Wyoming Valley were constructed and operated in the same way.

Only once was order in the courtroom broken. The chief engineer and major stockholder of the Delaware, Lackawanna, and Western Railroad Co., which leased Avondale, was asked if he considered it safe to have a mine with only one opening.

"There is more danger getting on a railway train and riding 100 miles than working in that mine," the engineer answered, "and no company in the country takes more pains than the Delaware, Lackawanna, and Western Railroad Company."

Enraged, a miner jumped to his feet and shouted that responsibility couldn't be shirked that easily. "We miners intend to prove that it is wrong—wrong to send men to work in such mines and that we have known it for long years," he yelled, "but we must work or starve. That is where the miners stand on this question." Loud applause that followed his remarks was silenced, and testimony continued until 4:30 p.m. Sunday, when the jury was dismissed to consider its verdict.

The decision reached several hours later changed mining history in Pennsylvania's anthracite region. The jury declared the cause of death to be the exhaustion of atmospheric air and the prevalence of sulfur fumes and blackdamp caused by the burning of the head house and breaker. They cited the furnace as the cause of fire, the sparks from which ignited the wooden brattice to the upcast air course leading from the bottom of the shaft to the head house. And in a final statement directed to the entire country, the jury strongly condemned the current state of mining as "insecure and unsafe to the miners," recommending "two places for ingress and egress, and more perfect ventilation, thereby rendering greater security to the lives of the miners under any similar accident." The jury's recommendations became the heart of the campaign for protective legislation, which consumed Pennsylvania state politics in 1870.

Seven months before the disaster at Avondale, the first mining law in the United States was passed in neighboring Schuylkill County. It provided not only for the safety and ventilation of mines, but also for the appointment of an inspector to enforce the law. The Schuylkill County Ventilation Act, however, applied only to that county. Efforts by miners in Pennsylvania's other counties to extend the law statewide met strong opposition from a Senator Coxe of Luzerne County in which the Avondale Mine was located. The mines in Luzerne, he said, were safe and in no need of protective legislation. He also maintained there was no demand for such legislation in his county, despite several petitions to the contrary signed by Luzerne miners. The Pennsylvania Legislature believed Senator Coxe, and the law that was passed in 1869 was limited to Schuylkill County.

Would the disaster at Avondale have been averted if the 1869 law had applied to Luzerne mines? The law, if enforced, possibly could have prevented the original fire because a provision specifically addressed furnace ventilation systems, setting standards "to prevent ignition of coal." No provision was made in the 1869 law for a second mine opening, through which trapped miners might escape.

The disaster at Avondale ended public indifference, and did for the miners of Pennsylvania what previous 19th Century disasters in the mining regions of England had done for the English miner. It was largely through such wholesale sacrifice of lives that better legislation for the protection of miners was secured. Miners were constantly being maimed and killed, either singly or in small groups, but these occurrences were regarded as "accidents" and went largely unnoticed. Usually, it was only when 100 or more miners died that the terms "disaster" or "catastrophe" were applied and national conscience piqued. Avondale received remarkably thorough press coverage, and the country rapidly became aware of the wretched working conditions which had become the heritage of the anthracite miner.

Demand by the public, press, labor unions and the mining community forced formerly reluctant legislators to pass the Ventilation Act of 1870. Considered by many to be the first important mining law in the United States, the 1870 Act drew heavily from the Schuylkill County Ventilation Act, but enlarged the scope of old provisions, added some entirely new ones and extended the law to the entire state of Pennsylvania.

The 1870 Act prohibited employment underground unless two outlets to each coal seam were provided within four months after passage of the Act. It provided for the first time that a definite minimum of pure air should be supplied to those employed underground, and prohibited the use of ventilation furnaces in mines where the breaker or chute buildings covered the top of the shaft. It provided for the inspection of all Pennsylvania coal mines and required inspectors to submit annual reports to the governor. Mine operators who violated the act could be punished by fine or imprisonment, and were liable if a fatal injury resulted from their negligence.

By today's standards, the law was toothless and enforcement of it ineffective. Throughout the late 1800s and early 1900s, coal mine disasters periodically were to jolt the public, and in some of the tragedies, the death toll was much higher than it was at Avondale.

However, considering the atmosphere of the times, Pennsylvania's Ventilation Act of 1870 was a significant achievement, a hard-won victory and a beginning in the long struggle to protect America's miners.

That the social and political climate was changing in this country—however slowly—in the late Nineteenth Century regarding the need for tougher mine safety laws is evident in this speech by John Siney to his fellow miners at Avondale the day after the disaster:

> *"Men, if you must die with your boots on, die for your families, your homes, your country, but do not longer consent to die like rats in a trap for those who take no more interest in you than in the pick you dig with. Let me ask if the men who own this mine would as unhesitatingly go down in it to win bread as the poor fellows whose lives were snuffed out beneath where we stand and who shall henceforth live with us only as a memory. If they did, would they not provide more than one avenue of escape? Aye, men, they surely would and what they would do for themselves they must be compelled by law to do for their workmen."*

Siney and other Pennsylvania miners got their wish. Cost of the future gain in miner protection, as always, was high—110 lives.

MSHA and NRC Agree on Regulatory Roles in Mill Safety

The Mine Safety and Health Administration (MSHA) and the Nuclear Regulatory Commission (NRC) have signed a memorandum of understanding in an effort to protect the health and safety of mill workers producing minerals for atomic energy, while reducing unnecessary and burdensome duplication in the work of each agency.

The agreement, effective Dec. 14, 1979 and published in the *Federal Register* of Jan. 4, 1980, defines the areas of cooperation between the agencies to increase administrative efficiency.

Both agencies will continue to issue regulations and to inspect operations where milling of "source materials" for atomic energy is carried out but this work will be carried out as a mutual effort, as far as possible.

The agreement provides that the agencies will:

- Issue and enforce compatible safety and health standards and regulations;
- Use compatible inspection techniques where feasible;
- Exchange information on safety and health protection in mills subject to mutual jurisdiction, as well as information pertinent to each agency's mission; and
- Exchange information on enforcement actions subject to jurisdiction of both agencies.

In developing health and safety standards and regulations, the agencies will hold joint public hearings. Both agencies will perform a 12-month trial joint inspection program. Based on an evaluation of the program's success, recommendations will then be made as to how the public interest can best be served by mutual agency cooperation.

"Our purpose in working together is to eliminate any conflict between Federal agencies and to assure uniform treatment of mine operators," said Dr. Aurel Goodwin, Chief, Division of Health, MSHA Metal and Nonmetal Mine Safety and Health.

Legal Briefs in Mining

NO WALKAROUND PAY FOR SPOT INSPECTIONS, COMMISSION RULES

Helen Mining Co. vs. Secretary of Labor, FMSHRC Docket No. PITT 79-11-P, decided Nov. 21, 1979.

Operators are not required to pay a miner for time spent participating in spot inspections, the Federal Mine Safety and Health Review Commission ruled, because it was Congress' intent to accord a walkaround pay right only for the so-called "regular" inspections in section 103(a) of the 1977 Mine Act.

The commission ruled that the legislative history indicated that the House-Senate conferees intended miner walkaround pay only for regular inspections and not for additional inspections otherwise permitted by the Act. The case has been appealed to the U.S. Court of Appeals for the District of Columbia.

COMMISSION RULES ON PAY FOR SPECIAL, SPOT INSPECTIONS

Kentland-Elkhorn Coal Corp., vs. Secretary of Labor, FMSHRC Docket No. PIKE 78-399, decided Nov. 30, 1979 and Allied Chemical Corp. vs. Secretary of Labor, FMSHRC Docket No. WEVA 79-148-D, decided Dec. 6, 1979.

Kentland-Elkhorn Coal Corp. did not have to pay a miner for accompanying an inspector during a special electrical inspection and Allied Chemical Corp. didn't have to pay a miner for participating in a spot ventilation inspection, the commission ruled. The ruling was based on the Helen Mining Co.'s decision. These cases have also been appealed.

OPERATOR MUST PAY ONE REPRESENTATIVE IN EACH INSPECTION PARTY

Magma Copper Co. vs. Secretary of Labor and the United Steelworkers of America, FMSHRC Docket No. 78-533-M, decided Dec. 10, 1979.

In a related case, the commission reversed an administrative law judge's decision and held that an operator must pay one miner's representative in each inspection party when the inspection is divided into two or more parties to simultaneously inspect different parts of the mine.

Walkaround pay was designed to improve the thoroughness of mine inspections, and where large mines require deployment of multiple inspection parties, each party must be assured of receiving the assistance of a miner's representative, ruled the commission.

COMMISSION REVERSES BOARD DECISION

Old Ben Coal Co. vs. Secretary of Labor, FMSHRC Docket No. VINC 74-11, decided Dec. 12, 1979.

Although some coal spillage may occur during mining operations, coal and coal dust accumulations are flatly prohibited, the commission ruled, reversing a 1977 Interior Board of Mine Operations Appeals decision. The board had ruled that the purpose of the standard was to promote operator cleanup programs; therefore, both accumulations, as well as the operator's failure to undertake cleanup in a reasonable time, were necessary to establish a violation. The board's decision was remanded to the review commission by the U.S. Court of Appeals for the District of Columbia Circuit since the commission was considering a case presenting the same issue. The commission said that the differences between an accumulation and a spillage are ones of size and amount.

The operator had learned of the accumulations, ranging from two to fourteen inches in depth on both sides of a belt driver for 925 feet from the midnight shift examiner report made between 4 and 7 a.m. However, the operator waited several hours after learning of the accumulations to begin cleanup according to the citation. The commission held the standard is violated whenever there is an accumulation of combustible material.

MINER WINS BEFORE THE COMMISSION

James F. Crumbaker vs. Pyro Mining Co., FMSHRC Docket No. BARB 79-313, decided Jan. 2, 1980.

In this case, a miner was able to prove that he had been illegally fired for making safety complaints. This is the first case in which a miner, in exercising the private right provided under section 105(c)(3) of the 1977 Mine Act, was able to obtain a favorable decision by the review commission on a complaint of discrimination.

The incident which led to the discrimination complaint occurred in November 1978. The mine foreman insisted that the miner bolt the face of an entry. The miner, claiming that it was unsafe for anyone to go through the crosscut, refused and later was fired.

The administrative law judge found that the company had not followed the roof control plan in that the bolts in the crosscut were dangerously placed beyond the legal distances permitted. The ALJ also found that the miner had been fired for insisting that the mine's plan be followed.

The judge ordered that the miner be reinstated to his job as a roof bolter, he be given all back pay due him and that any reference to the discharge be removed from the miner's personnel file.

Recent Additions to the MSHA Library

- **IR 1109—Design Guidelines for Coal Refuse Piles and Water, Sediment, or Slurry Impoundments and Impounding Structures,** by Staff, Mine Waste Branches, 29 pp., 15 Figs.

This publication presents the guidelines used by the Mine Waste Branches of MSHA's Denver and Pittsburgh Technical Support Centers and by MSHA district managers in their review of engineering plans for coal refuse impoundments. The guidelines cover the hydrologic, hydraulic, and geotechnical factors that should be considered in planning such structures. Following these guidelines will help speed MSHA's review of proposed engineering plans for these facilities.

Fourteen full-color photographs illustrate various aspects of the construction of coal waste impoundments. A checklist of items generally required for a comprehensive plan and specification review is included.

- **IR 1110—Frictional Ignition of Methane by Continuous Mining Machines in Underground Coal Mines,** by Edward M. Kawenski, George C. Price, and Clete R. Stephan, 12 pp., 5 Tables, 3 Figs.

This report presents information on frictional methane ignitions associated with continuous mining machines. Data indicate a gradual increase in frictional methane ignitions over the 6-year period 1971 through 1976. Ninety percent of these ignitions are attributed to continuous mining machines. Factors affecting such frictional ignitions are analyzed and recommendations are submitted for reducing their incidence.

- **IR 1112—Injury Experience in Coal Mining, 1978,** by Staff, Division of Mining Information Systems, 355 pp., 55 Tables, 3 Figs.

This report reviews in detail the occupational injury and illness experience in U.S. coal mining during 1978. Data reported by mine operators or work injuries are summarized by work location, part of body injured, occupation, cause, nature and severity of injury, with independent tabulations for anthracite, bituminous and all coal mining. Correlative information on employment, worktime and operating activity is also presented.

- **Safety Manual 16—Permissibility-Electric Face Equipment,** by Mac A. Carnes, 28 pp., 1 Table, 20 Figs.

The safety manual lists mandatory requirements and other pertinent information on permissibility of electric motor-driven underground mining equipment, as published in 30 CFR Part 18 (Schedule 2G), or 30 CFR Part 75.

This report is available through the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, GPO Stock No. 024-019-00034-9; price, $2.00. For 100 copies or more there is a 25 percent discount; for foreign deliveries there is a 25 percent surcharge.

HERE'S HOW TO OBTAIN REPORTS AND FILMS

Single copies of Informational Reports are available through:

MSHA, Office of Information
4015 Wilson Blvd., Rm. 1227
Ballston Tower No. 3
Arlington, Va. 22203

Films can be borrowed from the National Distribution Center in Pittsburgh, Pa. Send all requests to:

Motion Pictures
MSHA
4800 Forbes Ave.
Pittsburgh, Pa. 15213

Films can be purchased by directing requests to:

Chief, Division of Audio Visual Services
MSHA, Education and Training
4800 Forbes Ave.
Pittsburgh, Pa. 15213

News and Notes

Upcoming Meetings, Events

March

24-28	Mine Safety and Health Administration, short course, First Responder Emergency Medical Services, National Mine Health and Safety Academy, Beckley, W.Va. Contact Fran Rhodes, The Academy, Box 1166, Beckley, W.Va. 25801
24-April 4	Mine Safety and Health Administration, short course, Systems Safety Engineering, National Mine Health and Safety Academy, Beckley, W.Va. Contact Fran Rhodes, The Academy, Box 1166, Beckley, W.Va. 25801
26-April 2	Mine Safety and Health Administration, short course, The Radiation Hazard in Mining, National Mine Health and Safety Academy, Beckley, W. Va. Contact Fran Rhodes, The Academy, Box 1166, Beckley, W. Va. 25801

April

7-8	Colorado School of Mines, short course, Introduction to Uranium Technology, (Fee $210), Golden, Colo. Contact Office of Continuing Education, Colorado School of Mines, Golden, Colo. 80401

Stamp of Approval

The following equipment has been recently added to the Mine Safety and Health Administration's list of permissible or approved equipment:

- **Model 180P and 180R methane detectors,** issued to CSE Corp., Monroeville, Pa.;
- **Model No. 537A, 12-volt, battery-powered mine telephone,** issued to Western Electric Co., Newark, N.J.;
- **Model 10SC22, 440/550 volt, 3 phase, 60 hertz, alternating current shuttle car** with (2) Reliance 40 h.p. traction motors, a Reliance 25 h.p. conveyor motor, and a Reliance 10 h.p. pump motor, issued by the Joy Manufacturing Co., Franklin, Pa.;
- **Model 001 blower and dust collecting machine,** 440 volt, 3 phase, 60 hertz, alternating current, with (1) General Electric 460 volt, 30 h.p. motor; (1) Reliance 440 volt, 5 to 7½ h.p. motor; and (1) Joy 440 volt controller, issued to Bamco of West Virginia and B & J Manufacturing Co., Morgantown, W.Va.;
- **Longwall mining system,** 950 volt, 3 phase, 60 hertz, alternating current, with (1) 230 h.p., (2) 200 h.p., (2) 75 h.p., and (2) 40 h.p., 950-volt, a.c. motors, issued to Eickhoff-National Mine Co., Pittsburgh, Pa.;
- **Longwall mining system,** 950 volt, 3 phase, 60 hertz, alternating current, with (1) 300 k.w., (2) 75 h.p., (2) 200 h.p., and (1) 150 h.p. 950 volt a.c. motors, issued to National Mine Service Co., Ashland, Ky.;
- **Longwall mining system,** 950 volt, 3 phase, 60 hertz, alternating current, with (1) 275 h.p., (1) 40 h.p., (2) 150 h.p., and (2) 75 h.p., 950 volt motors, issued to Jeffrey Mining Machinery Division, Dresser Industries, Inc., Columbus, Ohio;
- **Model 21SC-A AC/DC shuttle car,** 440/550 volt, 3 phase, 60 hertz, alternating current with (1) 25 h.p., 440 or 550 volt AC conveyor/pump motor, (2) 20 h.p., 250 volt, d.c. traction motors, issued to Joy Manufacturing Co., Franklin, Pa.;
- **Goodyear Glide Coal Belting,** issued to Goodyear Tire and Rubber Co., Akron, Ohio;
- **Goodyear Grain Belting,** issued to Goodyear Tire and Rubber Co., Akron, Ohio;
- **Lo Temp Coal PN Conveyor Belt,** issued to B. F. Goodrich Co., Akron, Ohio;
- **Urelok FR Conveyor belting,** issued to Unilok, Scottdale, Ga.;
- **Safe-FRT 3100, Mine Conveyor Belt,** issued to Sumitomo Corporation of America, Chicago, Ill.;
- **Neoprene Sierra Mine Service Conveyor Belt,** issued to Victor Balata Belting Co., Newcastle, Calif.;
- **Megtek Chemical Battery Casting Compound X-811,** issued to C & D Battery Division, Plymouth Meeting, Pa.;
- **Vitralon Epoxy Powder Coating,** for use on battery trays (cases), issued to Pratt and Lambert, Buffalo, N.Y.;
- **Hose Conudit,** issued to Cambria Rubber Co., Inc., Trenton, N.J.;
- **ABC Vinolon FR Medium "B" plastic brattice cloth,** issued to Peabody ABC Corporation, Warsaw, Ind.;
- **Compound No. 04-5953, for use as cover on hydraulic hose,** issued to Uniroyal Inc., Middlebury, Conn.;
- **Black Hydraulic Hose Cover Compound 51011,** issued to Swan Hose Division, Amerace Corp., Bucyrus, Ohio;
- **Jiffywall surface bonding mortar,** issued to James River Libestone Co., Inc., Buchanan, Va.
- **CAFCO Mine-Shield mine sealant,** issued to U.S. Mineral Products Co., Stanhope, N.J.;
- **Neoprene Compound 100131-1, for use as electrical connectors,** issued to Cam-Lok Division, Empire Products, Inc., Cincinnati, Ohio;
- **Compound 60144, for use as chute lining and skirt board,** issued to B. F. Goodrich Co., Akron, Ohio;
- **Cover Compound No. 425-2, for use as hydraulic hose cover,** issued to Republic Hose Manufacturing Corp., Youngstown, Ohio;
- **IREMITE PX-1A and IREMITE PX-1C,** issued to Sireco Chemicals, Salt Lake City, Utah.

The poster on the following page is designed to encourage miners to observe and work toward improved safety practices. The poster, which was created by Art Director Columbus P. Knox, can be cut out of this issue and placed on bulletin boards or at other locations regularly passed by working miners.

Lumps 'N' Chunks

drawn by C. P. Knox

IN A SURFACE MINE MAINTENANCE SHOP
YOUR TRUCK'S READY, CAROL. OUGHTA WORK FOR AWHILE ANYWAY.
THANKS, TOM. YOU ALWAYS SEEM TO GET 'EM FIXED QUICK...
HOPE THAT OLD PART HOLDS THOSE BRAKES TOGETHER WE NEVER HAVE ENOUGH PARTS IN STOCK.
CAN'T STOP! GONNA HIT THE...
YOU @☆●≠!'#...! YOU ALMOST GOT ME KILLED
I'M SORRY! LAST TIME I'LL EVER TRY TO JURY-RIG ONE OF THESE JUNKERS...

Be Alert

Avoid Accidents

Persistence, Analytical Ability Needed

What does it take to be an effective investigator for MSHA's Program in Accident Reduction (PAR)?

"As a PAR investigator, you have to have the respect of both management and labor, so you have to know what you're talking about when you talk safety," said Bob Riley, manager of MSHA's Phoenix, Ariz., subdistrict for Metal and Nonmetal Mine Safety and Health and a man who has been closely involved with the PAR concept for a long time. "It goes without saying that you have to be experienced in mine safety."

He added, "Beyond that, we look for somebody who can work well with all kinds of people up and down the chain of responsibility. You should have a mature outlook and a lot of patience. Doing PAR work requires honesty as well as diplomacy."

There are, Riley said, two other qualities that all effective PAR investigators possess. They are analytical ability and the persistence of a bird dog in tracking down causes of mine accidents and identifying potentially dangerous practices and conditions.

"What we do in the Program in Accident Reduction," Riley said, "is something additional . . . , an allocation of our resources above and beyond what the Federal Mine Safety and Health Act of 1977 requires in the area of inspections.

"It's an evaluation of a company's safety policy, safety organization and program, as well as the communication of those policies and desires all through the mine's workforce. We bring the viewpoint of the outside safety professional to this, and the figures show the program works. But there has to be cooperation by all parties."

Ken Russell, MSHA's Bellevue, Wash., subdistrict manager, said, "We've talked a lot in this agency about the Three E's—Enforcement, Education and Engineering. When you get beyond the percent of hazardous conditions and practices that can be corrected by strict enforcemet of safety and health standards, you've got to start taking a harder look at policies and procedures, and working with people. In PAR the emphasis is on evaluation and education."

Myron Breland, safety specialist with MSHA's Reno, Nev., field office and the PAR coordinator for the Western District, which is responsible for metal and nonmetal mining safety and health in Arizona, California, Idaho, Nevada, Oregon and Washington, gave an example of the dogged persistence that sometimes is needed to uncover the true cause of a deficiency in a company's safety procedures.

In the early days of PAR's evolution from earlier Bureau of Mines' and Mining Enforcement and Safety Administration programs, Breland, a former miner, mining company level boss, and safety director, teamed up with Homer "Bud" Trussell, a veteran safety professional who is now supervisory mining engineer with MSHA's Boise, Idaho, field office, to make an extensive survey of western mines with good safety records to find out more about what makes a safety program work.

Safety (Continued from Page 7)

The mine developed a better system of inspecting rubber boots for wear and replacing boots when necessary to reduce the high incidence of chemical burns to workers' legs and feet.

Mine superintendent Tom Weitz put a new benching plan into effect at the pit to reduce hazards there. A safety berm was installed on the pit floor to control sloughing. Used bulldozer proved effective for scaling the pit wall. Berms on the haulage roads were improved.

"They went beyond our recommendations in a number of these areas," Clary said. "For example, we recommended formal safety training for management people. So the company had the key people take American Management Association courses and other top courses. They bought films that were useful and took other positive actions."

To Bud Trussell and the two PAR inspectors, the revision of the safety handbook for employees was one of the most heartening examples of the growing safety awareness at all levels of activity at the mine.

The strong statement of company safety policy was signed by Lyle Talbot. It said in part:

"We are well aware that our people are the prime resource, and, for that reason, their safety and health is our first consideration. Therefore, we will provide all necessary safeguards to insure safe working conditions and will train employees in safe work procedures.

"Additionally, we consider safety to be a line responsibility, and require management and supervisory personnel to be accountable for the safety of employees under their supervision, and to conduct operations in a safe and efficient manner.

"To achieve this, supervisors are required to integrate accident prevention into every phase of our operation so thoroughly that it is not definable as a separate function, and no job is considered to be efficiently, or even acceptably, completed unless the worker has followed every safety rule and taken every precaution to protect himself and his fellow employees from injury.

"We believe in the dignity and importance of the individual employee and in the right to derive personal satisfaction from your job. We also believe this can be best achieved in a safe working environment. To achieve these ideals, this policy is hereby established."

A statement in a booklet may not seem like much, even if signed by top management. But as John Moore pointed out, "Not many companies have gone on record with a commitment to safety as strong and comprehensive as the one at the beginning of the DeLamar Mine's safety manual. In our followup surveys, we found that this action by the company had a lot to do with improving morale

to Pinpoint Root Causes of Accidents

Later, they made PAR-type evaluations at mines that had relatively high injury rates. At one such mine, they found a lot of loose rock hanging around in most of the work places.

"When we questioned the miners," Breland said, "they told us they didn't have any bars to pry down the dangerous material. So we went to the management and asked why they hadn't made any bars available.

"The supervisory people said, 'We've been ordering the bars from outside all this time, but none came in.'

"So we went to the surface supply man, who blamed the warehouse for delays in delivery. He said the warehouse said it was out of pry bars. We kept asking questions. Why didn't anybody have the bars? And we kept tracing it back.

"Sometimes, it can be a paperwork foulup. But in this case, it seemed that the material they had been making the bars out of had been in short supply so they had stopped making the bars. There were alternative materials the bars could have been made of, and later this was used.

"Apparently, nobody had been worried about the situation or asked the kinds of questions we did. This often happens when you have different departments and different little regimes involved, and responsibilities for making decisions can slip through the cracks. Somebody can hit a snag and everything just stops."

Breland added, "When the problem of obtaining the bars was solved, the loose ground problem all but disappeared, and fall-of-ground injuries at that mine decreased."

"The philosophy underlying the Program in Accident Reduction," said Trussell, "is that you have to determine the root causes of accidents and help management and workers do what has to be done to eliminate these causes. An inspector can see the same types of violations occurring at a certain mine or mill and cite the operator for them, then see the same violations repeated in later inspections.

"At that point, it is logical to suppose that there is some hidden factor causing those violations to reappear like that. And, if you can persuade the people involved to go back and do some digging, they can find the cause and possibly chop off that whole series of violations. To see this happen and be a part of it is very rewarding to the PAR investigator."

Riley added, "In a PAR investigation, the physical deficiencies at a mine and the injury rates are indicators of less obvious problems somewhere else. The investigator follows the chain of responsibility back to perhaps a seemingly insignificant oversight or failure in policies, communications or procedures that actually has serious consequences . . ."

at the mine."

As 1979 drew to a close, management and workers at the DeLamar Silver Mine could take satisfaction in a noteworthy achievement.

The injury incidence rate per 200,000 employee hours worked at the mine dropped from 13.76 in 1978 to only 4.13 in 1979, again, as in 1978, with no fatalities.

"I don't know how much of the success we had can be assigned to our own safety efforts under Larry Buter and later Bob Parrish or how much was due to the PAR program," Lyle Talbot said recently.

He added, "There's no doubt that Frank and John have made a difference, though. From our viewpoint, one of the best things they did was to function as a sounding board for our people. Some of our employees told them things that weren't even safety related that needed to be corrected."

Frank Clary said, "We didn't really do anything there. The people at the mine did everything themselves. All we did was create a focal point so they could see what their problems were a little better and work them out themselves."

And Bud Trussell added, "John and Frank helped make a communications opening. The DeLamar had all the elements of a good safety program all along, but these elements just needed to be brought together.

Bob Parrish has since moved on to a challenging job elsewhere, and an acting successor, Joe Bongiovi, is carrying on the established safety program.

"One of the most important things PAR does is make you safety conscious," Parrish said. "Getting the injuries down was a joint effort, but PAR played a big part. We knew the PAR team wasn't just out here to find fault, but was primarily interested in improving safety." He and Talbot often called the MSHA field office between PAR followup visits to discuss the safety program and clarify interpretations of safety regulations.

To Frank Clary, it was the PAR team's focus on "intangibles" that proved most useful in helping the company reduce injuries.

"Their equipment maintenance, mechanical guarding and other obvious practices were excellent," he said, "but they still were having those accidents through 1978, so you're talking about communications problems and other intangibles.

"And, in fact, our survey showed that this was an area with considerable room for improvement. Some people up and down the chain of responsibility weren't really talking to each other, but they really weren't aware of what effect this had on safety. They were too close to the situation. Coming in from the outside as we did, with a strictly safety approach, we could see things that people who were close to the job had trouble seeing."

It is safe to say that no corporate vice president or mine manager is exactly overjoyed to learn that his mine has just "made" MSHA's Program in Accident Reduction list for the coming year. Many executives simply cannot believe that accident-injury statistics for their mines are out of line with national statistics. When shown the painstaking process used by MSHA's Health and Safety Analysis Center to compile the PAR list, however, most of the executives, managers and safety directors accept that the selection criteria are fair, and they come to support the subsequent PAR efforts.

In the next (March-April 1980) issue of Mine Safety and Health magazine, the criteria for selecting metal and nonmetal mines for special PAR attention will be covered in some detail by John Kogut, chief of HSAC's statistical support and forecasting branch, division of special studies.

Briefly, however, mines are chosen for the Program in Accident Reduction on the basis of their combined scores on two indices.

The first score is obtained by applying a weighting factor to each lost-workday injury reported over a one-year period. The weighting factor is proportional to the national average number of days lost for injuries of that type. The weighted injuries are then summed up, divided by the mine's exposure time in employee hours worked, and adjusted mathematically to stabilize random fluctuations.

The second score is determined by comparing over a three-year period the mine's lost work day injury rate with the national rate for mines of the same general type. For each of the 12 quarters, using employment figures reported by the mine, a calculation is made of the number of lost-workday injuries that would be expected at the mine if it were experiencing injuries at the national rate. The quarterly differences between the expected number and the number actually experienced are used to project a positive or negative surplus for the coming year.

In the charts accompanying this article, the year-to-year reductions and increases in metal and nonmetal mining deaths and injuries are shown for 1976-1979.

Where possible, yearly comparisons are made between groups of selected PAR mines and all of the Nation's metal and nonmetal mines. As can be seen, results for the PAR groups generally were more dramatic than results for the total non-coal mine population. However, it should be kept in mind that the PAR mines, with injury rates well above the national norm to begin with have had considerably more room for dramatic safety improvement than the average mine did.

Not shown on the charts is the wide variation in the accident reduction program's results among individual PAR mines of the same type over a given period.

For example, in the Phoenix, Ariz., subdistrict of MSHA's Western District, Metal and Nonmetal Mine Safety and Health, for the third quarter of 1979, nine mines and mills under the Program in Accident Reduction showed an average decrease of 49 percent in lost-day injuries, compared with the same period in 1978, while three mines showed an average increase of 17 percent in injuries for the two periods.

The total lost-day injuries for all 12 PAR mines in the subdistrict dropped from 356 to 202—or 154 fewer injuries (a 43 percent reduction). However, there was a spread of 169 percent between the mine with the smallest percentage decrease and the mine with the highest percentage increase in injuries among the 12 mines for the third quarters of 1978 and 1979.

The statistics clearly show that PAR has benefited the majority of mines and mills that have been under the program, although some mines on the PAR list have not improved—and a relatively few of these have become even less safe than before.

Exactly why the program doesn't work at some operations is not always clear. Among possible reasons: the PAR team assigned to one mine may be less effective than the team assigned to another mine; the safety problems at a specific mine may be so serious that they take longer than expected to fully correct; and a mine's management may be lukewarm to the PAR effort or actively oppose it.

"We don't claim that we always do things just right," said Tom Lukins, the Western District manager. "A good bit of this is human relations and that can sometimes be a hazy area. But even when we think we are doing a good job, we don't expect to get positive results in a very short time. A mine can have some success and then start backsliding. When this happens, we know we have a lot more work to do."

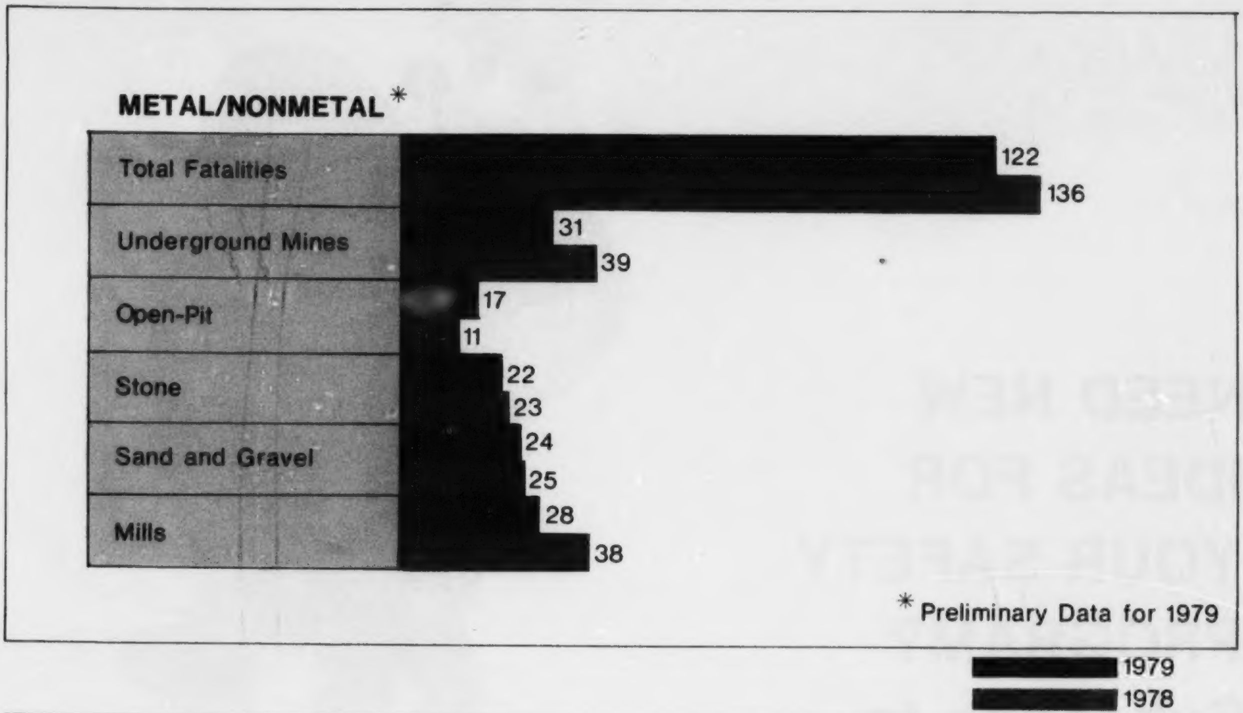
In recent months, MSHA has held a series of conferences for PAR coordinators and inspectors from offices throughout the country with the aim of achieving more uniformity in the program and improving the training of PAR personnel. A training course tailored specifically to the needs of PAR field people is being developed for use at the National Mine Health and Safety Academy, Beckley, W.Va.

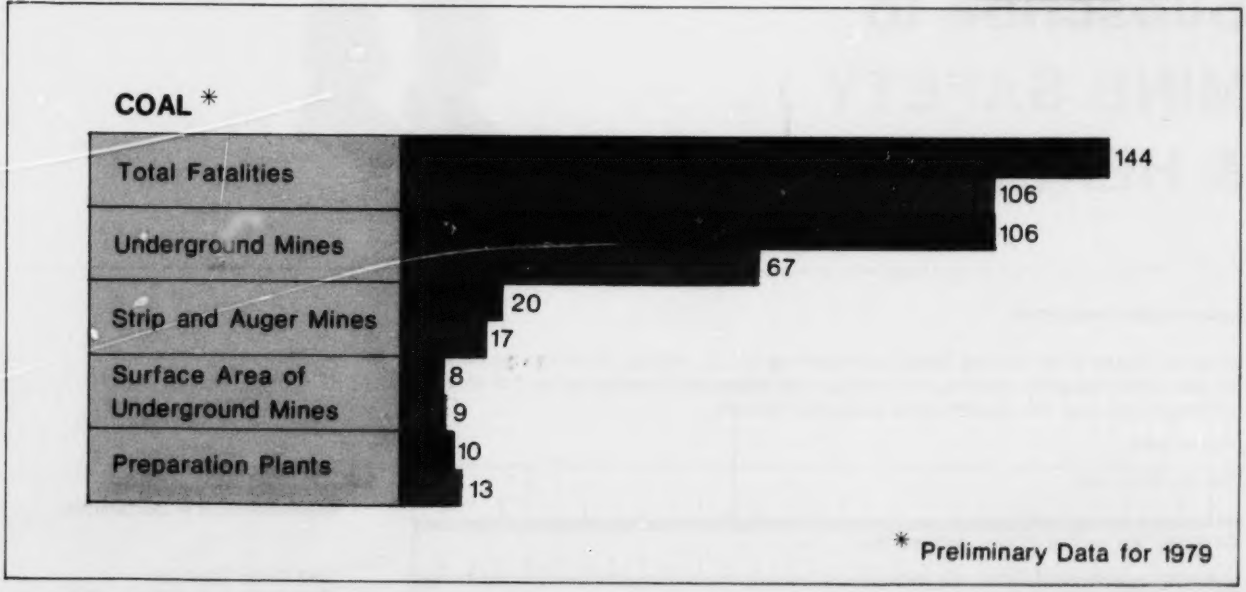
"What we do counts for a lot, obviously," said MSHA's Tom Lukins. "How a company's miners receive the program can make a big difference. But there's just no getting around it. If top management doesn't cooperate, PAR won't work."

He added, "If you look at the successes and failures in PAR over the years, you find a striking correlation between a company's safety attitude and the amount of cooperation they extended to the program and the statistical results. Almost without exception, where top management was cooperative, the results were good. Where they weren't interested or were opposed to the whole idea, the results were less impressive, and, in many cases, the injuries continued to go up.

The discussion of the Program in Accident Reduction in metal and nonmetal mining will continue in the next (March-April 1980) issue. The second article will cover examples of PAR activities throughout the country, including those in Ohio, Minnesota, Arizona, Nevada, Mississippi and other states; the PAR philosophy and the combination of qualities considered desirable in a PAR inspector; and further details on criteria used to select PAR mines.

FATALITIES in U. S. Mines During 1978 and 1979





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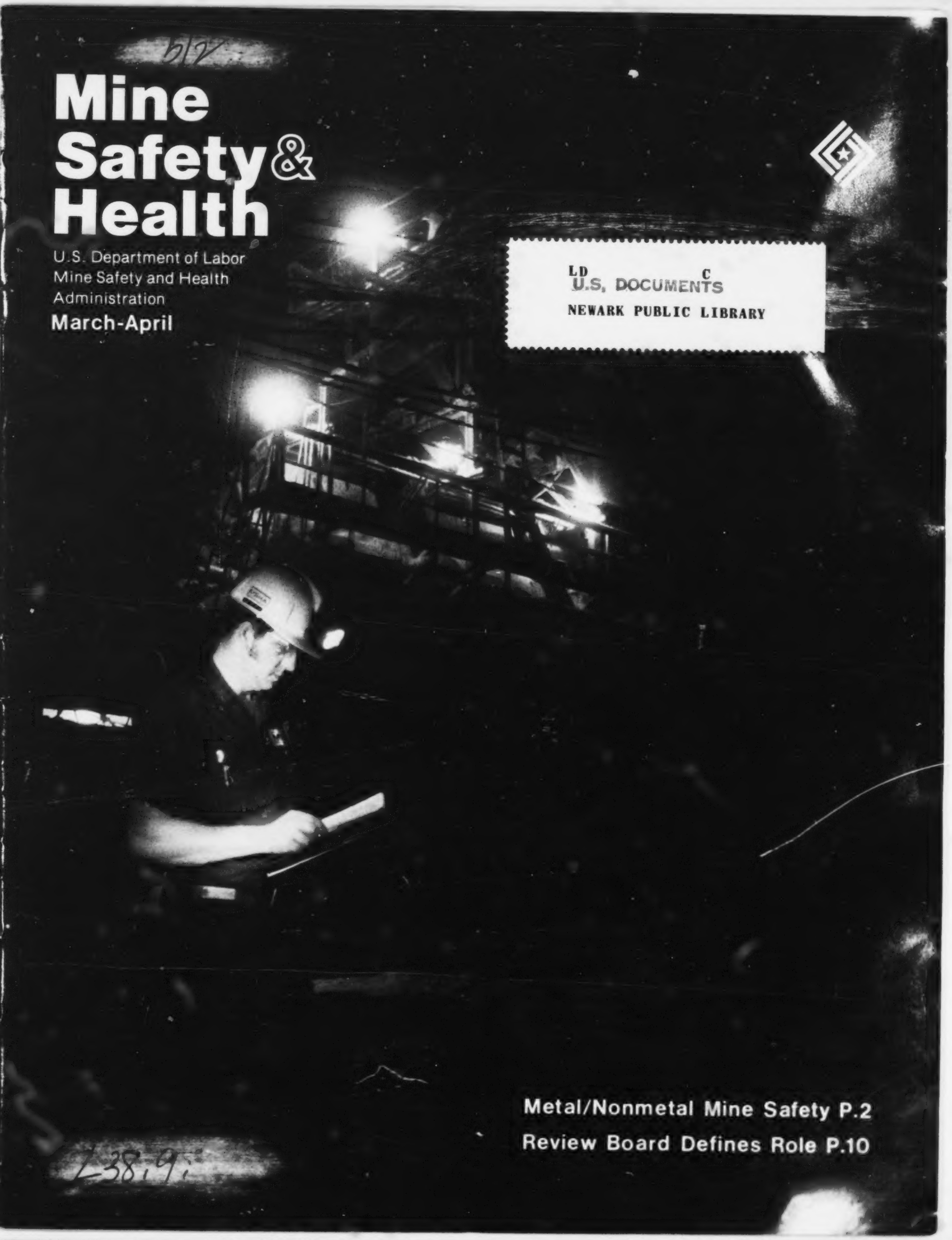

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Metal/Nonmetal Mine Safety P.2
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John Finley and his 'Court'...

By Excel Warren Jr., Mine Inspector
Dallas Subdistrict Field Office
Metal and Nonmetal Mine Safety and Health

I would like to share with you my experience at one of the mine properties I inspect, the Arkansas Cement limestone mining and milling operation in Southwest Arkansas, which employs about 225 people. The company has a unique accident reduction program which was developed by John Finley, its safety director.

Finley, who has held several posts in the safety field and is now working toward a Master's Degree in safety engineering in his spare time, first became interested in safety while teaching driver education to high school students. Over the years, he has become firmly convinced that people perform better when they are held accountable. A one-time football coach, he believes in leaving nothing to chance in executing any program that relies heavily on human motivation, training and elaborate attention to detail.

At Arkansas Cement, which Finley joined in 1970, he has emphasized the accountability of supervisors and workers in making the working environment safe.

His main tools in promoting safety at Arkansas Cement: a Polaroid camera and a tape recorder.

Finley was well liked at the mine before he began his accident reduction campaign. But his popularity faded when he began carrying the camera with him on his daily rounds of the plant and quarry, using it to snap pictures of unsafe conditions and practices in every department: a guard left off a piece of machinery, a pile of rags in a corner, unsecured compressed gas cylinders, a lock left off an electrical installation, an example of poor equipment maintenance, and other deficiencies. The photos were sent to Jim Gordon, vice president of the operation, who initialed and forwarded them to the appropriate supervisor for action.

Finley's popularity suffered a further decline when he began snapping pictures during surprise inspections on the afternoon shift or at 3 a.m. or other unexpected times and places. But unsafe acts and conditions also declined.

Finley wasn't satisfied, however. Safety hazards were being documented, but no one was being held accountable. To remedy the situation, Finley started a program of regular safety meetings and an unusual information-gathering session which employees have named "Finley's Court."

Monthly safety meetings, now required in every department at Arkansas Cement, follow a form which includes the names of people present, a safety topic chosen by the department, unsafe conditions or practices reported, and comments or recommendations to correct the problems.

After each meeting, the completed form is routed to the vice president, plant manager, foreman and safety director. Finley's program also requires a similar departmental safety meeting to be held within two days of an accident involving a lost-time injury or treatment by a doctor.

JOHN FINLEY

The heart of the program is "Finley's Court." When an accident occurs, the department head, the foreman and the employee or employees involved are brought to Finley's office. The meeting is formal, usually lasts 10 or 15 minutes, and is tape recorded.

To the employee(s), Finley asks:

- "What time did you start work?"
- "How many hours did you work yesterday?"
- "How did the accident happen?"
- "Did you know of the hazard or equipment defect?"
- "Why was the hazardous condition or practice not caught on a normal inspection?"
- "Have you been properly trained?"

To the employee's supervisor, he asks:

- "Did your supervisor know of the defect or hazard?"
- "If so, why did you allow the condition to exist or the equipment to be used?"
- "Did you remind your employee to work safely today?"
- "Did you examine the equipment or hazard?"
- "What did you do to contribute to the accident?"
- "Has your employee been properly trained?"

And to the department head, supervisor and employee, he asks:

"What could each of you have done to prevent the accident?"

I listened to one of Finley's tapes, and would not like to be a participant in "Finley's Court." By the end of the tape, there usually is no doubt in anyone's mind who is responsible for the accident.

Every 12 months, all miners who have had one, two or three lost-time accidents are brought to Finley's office to discuss their safety records. One miner was averaging an accident a month. After his accountability was established in "Finley's Court," he has been accident-free for two years.

Finley's plant inspections are as tough as his courts. If he finds a serious safety hazard, he tags it and shuts down the department. Only after the condition has been remedied and approved by the plant manager is the section reopened.

As an added incentive to increase safety awareness, Finley holds quarterly safety award drawings for employees with no lost-time accidents during the year.

Mine Safety & Health

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The lights in a crushing facility work area of an underground salt mine form an eerie backdrop as MSHA inspector Mickey Akers takes notes on safety conditions in the cavernous mine. The photo is by Ralph Lewis.

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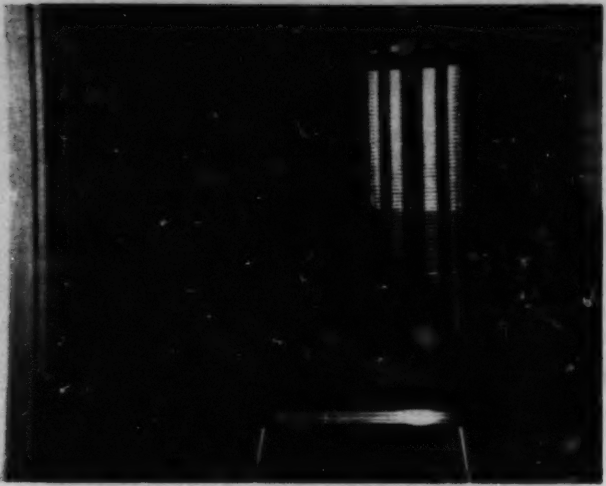
Samuel A. Stafford, Editor, Mine Safety and Health Magazine; Ralph E. Lewis, Assistant Editor; Columbus E. Knox, Art Director; Fred Bigio, Graphics Consultant; Sharon Maines, Editorial Clerk. Photos with article on MSHA Program in Accident Reduction(PAR) by Clyde McMillian, Myron Breland, and Homer Trussell, Metal and Nonmetal Mine Safety and Health; Photos with article on the Federal Mine Safety and Health Review Commission by Ralph Lewis; photos with article on the use of satellite photography to detect potential mine roof problems by Roger Schmidt, Coal Mine Safety and Health and Denver Technical Support Center personnel; Depictions of historical scenes used as a basis for artwork by Columbus Knox which accompanied an article on the Avondale Mine disaster (January-February issue) were provided by Clarence Lee, MSHA assessments specialist, Wilkes Barre, Pa.

Working together, management, union, workers and MSHA representatives achieved a dramatic reduction in lost-time injuries at the Oil Dri Production Co.'s Mine and Mill at Ripley, Miss., last year, following an intensive Program in Accident Reduction (PAR) conducted by MSHA. In several instances, the company made beneficial changes in policies and practices that went beyond MSHA recommendations.



MSHA's Clyde McMillian, center, and Walter Turner, second from left, discuss procedures to reduce accidents at the Oil Dri Co.'s Ripley, Miss., operation with Doyle Bennett, a bagging worker and member of the mine's safety committee, left; E. J. Albritton, plant manager who has since become an Oil Dri executive in Chicago, second from right, and Howell Duncan, safety director and assistant plant manager.

'PAR' Effort Emphasizes Cooperation

Metal/Nonmetal Safety Program Proves Effective at Many Mines

This is the second of two articles on a Mine Safety and Health Administration accident prevention program called the Program in Accident Reduction (PAR), which has been conducted for several years at certain metal and nonmetal mines. Over the years, the record has shown significant reductions in injury incidence rates at most mines at which mine managers, safety directors, union representatives and workers have actively supported the program. The following article offers further illustrations of the considerable impact of PAR activities at some of the Nation's metal and nonmetal mines.—The Editor.

In 1979, MSHA designated 60 of the Nation's metal and nonmetal mines for special attention because their safety performance the previous year had been well below the national norm for similar type mines.

One of these was the Oil Dri Production Co.'s Ripley Mine and Mill in Ripley, Miss., whose employees recover and process minerals for oil-absorbing materials and other products.

During 1978, accident records showed that 13 of the mine's 80 employees, or 16 percent of the workforce, had suffered injuries that resulted in lost work time. The incidence rate for injuries in which work days were lost during the year was 14.35 per 200,000 hours worked at Oil Dri's Ripley Mine, nearly three times as high as the national average incidence rate of 4.87 for similar mines in 1978.

Late in 1978, when it had become obvious to personnel in MSHA's Southeastern District Office, Metal and Nonmetal Mine Safety and Health, that the Ripley Mine was close to making the list of mines selected to participate in MSHA's cooperative Program in Accident Reduction (PAR), representatives of MSHA's Greenwood, Miss., field office contacted company officials to discuss ways of reducing injury rates.

"We pointed out that our records showed a higher-than-average lost time injury rate at the Ripley Mine and we told them about the services we could offer them under the Program in Accident Reduction," said Clyde McMillian, supervisory mine inspector at the Greenwood field office.

"Like many operators, they hadn't heard about PAR before. I think they were surprised and somewhat concerned to find out that their injury rates were out of line with other mines nationally, but they were receptive. Later that year, before we formally began our PAR work at the mine, they set up a joint management-union safety committee to make regular safety inspections and took other actions that showed us they meant business in dealing with the safety problem."

Those in MSHA who have been most closely associated with the Program in Accident Reduction during the more than four years that the program has operated throughout the country have found that PAR has been most successful where top management has strongly supported the program.

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In the case of the Ripley Mine, both company officials and representatives of the mine's union, the United Rubber Workers, enthusiastically embraced the PAR effort.

Early in 1979, McMillian and Walter Turner, a mine inspector and PAR investigator from the Greenwood office, met with union and company officials to outline standard procedures used to conduct the special accident reduction program. At that time, E. J. Albritton, who was then plant manager, said that both management and the union recognized the seriousness of the problem and welcomed MSHA's help.

The PAR concept rests on the premise that routine inspections to assure compliance with Federal regulations cannot achieve desired safety results alone. MSHA's PAR activities complement its enforcement responsibility under the Federal Mine Safety and Health Act of 1977 by helping selected companies to better evaluate and strengthen their safety policies and programs.

The PAR investigator, as an outside safety professional, works closely with all parties at a mine to pinpoint unsafe practices and conditions, to develop better communications of safety policies, and to find and eliminate any weaknesses in personnel relationships that could contribute to accidents.

> *"We knew we had problems, and we wanted MSHA to come in and help us find out what was wrong. We used all the tools available to us to bring those injuries down, including the tools MSHA gave us . . . But we couldn't have done it by ourselves. The (PAR) program has been a tremendous help. I can't say anything but good about it."*

Before starting the PAR investigation at the Oil Dri Mine, the staff of the Greenwood field office had studied accident reports and data supplied by MSHA's Health and Safety Analysis Center (HSAC) in Denver, and prepared a breakdown of accidents at the mine by type, day of the week, place of occurrence, occupation of the victim and other factors. Such analyses often provide PAR investigators with valuable clues to accident trends and to accident causes that are not immediately apparent.

After reviewing accident and injury data with the Ripley Mine's management-union safety committee, Turner explained that he wanted to talk to as many employees as possible. Committee members told him to go ahead.

In ensuing weeks, Turner intensively monitored all pit and plant operations, including excavation, loading, haulage, shredding, drying, bagging and other operations, and interviewed Oil Dri's top managers, supervisors, union representatives and workers.

MSHA Program in Accident Reduction (PAR) investigator Walter Turner, left, explains proper lifting techniques to Charles Vandygriff, a bagging worker who heads the Ripley, Miss., mine's United Rubber Workers union local and is a safety committee member. Through improved procedures, lost-time injuries in the mine's bagging operation were reduced to zero last year.

Besides observing work practices and conditions, Turner studied the work flow process, inspection and followup procedures, safety accountability of managers and supervisors, safety training needs and other areas. He also analyzed and checked the accuracy of all accident data reported by the company after the investigation began.

Turner's findings were duly relayed to management. They included the following:

- The mine's safety policies and procedures were not being effectively communicated to workers from higher-ups;
- Employees in some departments had a poor understanding of proper work procedures, and hazardous practices were observed in some working areas;
- Safety training was poorly conceived and structured; in particular, the mine lacked an adequate emergency first aid training program;
- Poor housekeeping in some mine and mill areas created potential hazards.

"We saw a big change in attitudes at all levels early in the program," Turner said recently. "Management took our recommendations to heart and began to put them into effect. In fact, the company even asked employees to come up with ideas for improving safety. There was a lot more safety awareness than before."

If PAR was the catalyst for some beneficial changes made at the Ripley Mine during 1979, company officials and union representatives instituted other changes on their own that went beyond MSHA's specific recommendations.

MSHA's study of company accident records had shown unusually high lost work time due to injuries involving sprains and strains in the bagging operation. During his investigation, Turner had observed that workmen habitually stacked bags higher than was necessary, that loads were being lifted that were too heavy for one person, and that employees were using unsafe lifting techniques. These deficiencies were corrected, and, as it

Top officials of the Oil Dri Production Co. and the management and union at the company's Ripley, Miss., Mine and Mill strongly supported the special accident reduction program conducted at the mine during 1979.

turned out, no lost-time injuries would be recorded in the bagging operation during 1979.

During the year, the joint safety committee conducted monthly inspections of the entire operation, and discussed detailed reports of their findings at safety meetings with management. Later, the reports were given to department supervisors for possible action.

Basic and refresher first aid courses were given to all supervisors and employees, and the safety training program was strengthened. General cleanup in all areas improved considerably during 1979. In addition, the company began a safety incentive program, awarding U.S. savings bonds valued at up to $100 and merchandise to persons who had worked for long periods with no lost-time injuries.

During 1979, directives were issued requiring proper daily inspection and maintenance of all mobile equipment by the operator, using a safety checklist. Because of a shortage of diesel fuel at that time, all haulage trucks had been converted to run on propane. The hazards involved in using propane were thoroughly discussed with all employees who repaired or handled the trucks.

The Oil Dri Co.'s Ripley Mine is no longer on the PAR list. The improvement in the mine's accident and injury record during the year was dramatic, to say the least.

It will be recalled that, in 1978, about 16 percent of the workforce had suffered lost-time injuries, and the mine's incidence rate was 14.35 per 200,000 working hours. During 1979, not one employee suffered a lost-time injury, making the incidence rate zero.

Richard Chapman, Oil Dri vice president of production at the company's Chicago headquarters, strongly supported and closely followed successful PAR efforts at both the Ripley Mine last year and another Oil Dri operation, the Simpson Mine and Mill, Ochlocknee, Ga., in 1978.

A Safety Director's View . . .

Mr. Tom Lukins
District Manager, MSHA
Alameda, Cal.

Dear Mr. Lukins:

It is with great pleasure that I am writing you this letter. As you know our plant was put under the PAR program beginning in September 1979 due to an unusually high accident rate.

Upon receiving notification of the PAR correspondence we were, at first, very uneasy about the entire program and its concept. Having worked for the government myself for 14 years, I was, needless to say, quite hesitant to accept any assistance program on face value. In my wildest dreams I could not have been farther from the truth.

From the entrance briefing, and on successive visits paid by your team, there was nothing but honest, professional, and direct suggestions, constructive criticism, and even some positive comments.

As a result of the efforts of your team and our safety personnel, correct reporting techniques, intensive accident prevention programs and hard work, our plant has been put back on its own again.

The personal conduct of your teams, at our location, which consisted of Darrell King, Duane Cowley and Al Lords, was at all times direct, professional and above reproach. Our production and direct labor force even got to the point where they looked forward to an upcoming PAR visit.

It is indeed gratifying to me personally, that, in the era of government control and bureaucracy, such a program exists. If all your teams possess the skills and knowledge of the team we had, your program cannot be anything but a giant success.

As an individual, I would be sadly lacking if I did not make special mention of the assistance personally provided me by Mr. Darrell King. Even in my years of government service, I never met or heard of anyone who possessed Darrell's attributes. Honest, direct, professional, dedicated and knowledgeable cannot express my opinion of his actions and contribution to our safety program. The highest compliment that I can pay him is that I respect the man, and I sincerely hope he can call me friend, as I can him.

Please convey to all concerned our heartfelt thanks for their help and assistance to our safety program.

Yours for Better Safety,

John P. Sluder, Safety Director
American Borate Co., Dunn Mill
Yermo, Cal.

At the Simpson Mine, the number of injuries was reduced by two-thirds and lost work days were reduced from 234 to 44 from 1977 to 1978.

Did Chapman feel that the Program in Accident Reduction had significantly contributed to the improved safety records at the two Oil Dri operations?

"Absolutely," he said.

"We knew we had problems, and we wanted MSHA to come in and help us find out what was wrong. We used all the tools available to us to bring those injuries down, including the tools MSHA gave us. We even made some key management changes.

"But we couldn't have done it by ourselves. The (PAR) program has been a tremendous help. I can't say anything but good about it."

In MSHA's Southeastern District, headed by Horst Gottschalk, six 1979 PAR operations, including Oil Dri's Ripley Mine, showed sufficient safety improvement to be removed from the program this year.

These included the Bellwood Quarry and Plant in Atlanta, Ga., which had 13 lost-time injuries and an injury incidence rate of 32.78—much higher than the national rate for similar mines—during 1978, and no injuries and thus a zero incidence rate in 1979. This program was conducted by inspector G. G. Hamrick, of the Birmingham District's Macon field office.

In 1978, the Alabama Limestone Corp.'s Rockwood Mine in Rockwood, Ala., had an injury incidence rate of 98.10 per 200,000 employee hours—hours worked in its mill—about 12 times the national rate for similar mines that year. Following a program conducted by PAR investigator William Wilkie in 1979, the rate dropped to 21.79. The decrease was largely attributed to a special effort to reduce disabling accidents at the scrap stone truck loading station.

"PAR Changed Our Safety Attitudes"

Between April and October 1978, MSHA's Robert Barnes conducted special programs in Accident Reduction (PAR) at eight sand and gravel operations of the Dravo Corp.'s Ohio Gravel Division in the Cincinnati, Ohio, area.

Accompanying Barnes on his rounds was William Garlitz, then industrial relations manager for the division who has since taken another post with Dravo. Accident and injury rates had been unusually high at the division's operations, which had from 10 to 50 employees, and Garlitz offered Barnes his full support in the effort to reduce the rates.

"Bob pointed out safety hazards we had been trying to find for years," Garlitz said. "When he told the men about fatalities at other operations in the area that had the same kinds of hazards that we did, they really sat up and took notice. He had all of us looking for dangerous activities and situations every hour of the day."

He added, "For my money, PAR is right on target. The company felt the program was very helpful in improving our safety record. I think the most important thing was that it changed a lot of our attitudes toward safety. Both the supervisors and other employees began thinking differently about a lot of things we had taken for granted before."

Two years ago, the Black River Mining Co.'s Pendleton Mill had an injury incidence rate of 24.88. Last year, inspector John Pfaff, of the Knoxville Subdistrict's Lexington, Ky., field office, conducted an intensive PAR effort at the mill. Subsequently, the rate was cut by nearly half, to 10.50.

The experience of Birmingham Subdistrict PAR specialists at a Puerto Rican operation, the San Juan Cement Co., has been much less rewarding.

The PAR team and company failed to meet 1979 accident reduction goals despite what MSHA inspector P. A. Sarkis called "one of the most intensive programs the Southeastern District ever conducted."

The setback was attributed to a variety of factors and events. Among these: a truck drivers' strike and unusual equipment breakage which caused plant shutdowns and layoffs; a company reorganization that may have affected the morale of supervisors; an unorthodox local government system of handling workmen's compensation cases; and the necessity of reconciling the views of three different unions.

"It was tough going," said Claude Narramore, Birmingham Subdistrict manager. We and the company and unions made a lot of progress last year, but not enough so the company could get off the PAR list. Injuries were reduced, but the turnaround came too late in 1979 so they're still on the program this year.

Safety committee members at the Ripley, Miss., mine check operation of a newly installed control panel for the milling area. Left to right, are: Doyle Bennett, a bagger; Thomas Graves, workers' representative; Wayne Vandygriff, packaging supervisor; Richard Roberson, warehouse supervisor; Butch Brock, mechanic; and Howell Duncan, safety director and assistant plant manager.

"We feel that, at the end of the year, they'll have a record that's no worse than the national average, and, if they do, considering all the problems, it will be amazing."

Narramore said, "One of the past programs we're most proud of is the one at the Meigs Mine (Waverly Mineral Products, Meigs, Ga.), which Mac(Clyde McMillian) himself handled."

Sixteen employees of the Meigs Mine suffered disabling injuries resulting in 6,780 lost work days during 1976. In contrast, only two workers had accidents resulting in 13 lost work days in 1977. Both management and the company union, United Steel Workers Local 8290, fully supported the program.

In his final report, McMillian wrote, "The role that I attempted in this program was to try to motivate company personnel and find the problems. The direction and emphasis I would have taken had I had complete say over this program would perhaps have been different, but I never would have generated the pride that the people of this company now have because they developed their own program and made it work.

"A special thanks to (Plant Manager) Robert Smith, the man at the top, who made it work."

McMillian, like PAR specialists elsewhere, often takes pains to point out that company personnel, not MSHA investigators, are mainly responsible for making the Program in Accident Reduction work—and should get most of the credit when a program is successful.

"We provide a special focus and a background of safety knowledge that the average company doesn't have on the property," he said. "We can also encourage better communication of company safety policies throughout the workforce. But we don't make the changes. They do."

PAR investigators also are instructed to look for the good things about operators' safety programs. PAR evaluation reports frequently contain examples of excellent safety policies or practices in such areas as equipment maintenance, equipment guarding, underground communications, blasting site clearance, loading and haulage, ground control, basic housekeeping, safety training and others at mines which have safety deficiencies in other areas.

What qualities does the effective PAR investigator bring to the program?

"You have to know what you're doing and be able to convince people at the mine that you're sincere in trying to help them solve their safety problems," one MSHA district manager said. You have to be able to work well with people at all levels of responsibility. PAR work takes patience."

Perseverance and an eye for obscure or hidden factors that can cause accidents also are useful qualities in a PAR investigator.

"You have to keep your eyes open," said Homer "Bud" Trussell, supervisory mining engineer at MSHA's field office in Boise, Idaho, "and just keep asking questions until you get to the heart of a safety problem."

Trussell recalled an example of this question-and-answer process during a series of PAR-type evaluations he once made with Myron Breland, who now is a safety specialist with MSHA's Reno, Nev., field office and the PAR coordinator for the Western District.

"At one western operation," Trussell said, "they were loading an ammonium nitrate-fuel oil compound (ANFO or 'prill') by blowing it out of the loading pots with compressed air. We noticed that these loading air pots didn't have any grounding straps to prevent premature detonation due to static electricity during loading operations.

"So we asked a miner if he had ever been 'bit'—or shocked—and he said, 'Yeah, it gets pretty hot sometimes.'

"We took a close look at those air pots. When we asked where the grounding straps were, one man said he didn't know. He said the strap was on a pot about a month before and he didn't know what had happened to it. Nobody had thought it was necessary to provide a grounding strap, and it was inconvenient to put out a ground rod or tie it into a line somewhere to drain off the static electricity.

"We found this repeated in several places. So we asked the company safety director why the situation hadn't been corrected. He was unable to give a good reason, but told us that all the grounding straps had been properly in place during earlier inspections of blasting sites.

"The company put the straps on right away, but we found out that miners were still getting shocks. So we went beyond the problem of straps and started looking at their semi-conductive loading hose.

"We found that they were using PVC pipe, which did not contain the conductive material that could drain off the static electricity during loading.

"We kept asking questions, and finally traced responsibility for this hazardous practice back to the mine's purchasing agent, who, we found, had looked at the comparative prices between semi-conductive loading hose and the PVC pipe and had then bought the cheaper PVC pipe because he considered the two materials equally effective in doing the job.

Trussell added, "This was just one of a number of examples of how the PAR approach can be used to follow the chain of responsibility back to the source. In this case, it was possible to pinpoint a bad decision by an employee

that could have led to a serious accident and to call it to the attention of management so it could be corrected."

Nationally, a high percentage of "special attention" mines have been able to work their way off the PAR list in one year by slashing their accident-injury rates. Others have required longer to bring their safety records into line with national figures. And, regrettably, there have been some operations which showed little improvement or became even less safe than the year before.

During the four years that the program has operated throughout the country, PAR mines have averaged a 45 percent reduction in fatalities, compared to a five percent increase for all other metal and nonmetal mines; and PAR operations have shown a 22 percent average drop in the rate of disabling or lost-day injuries per hours worked, compared to a 10 percent rise for all other metal and nonmetal mines.

In 1979, most PAR mines in the Salt Lake City Subdistrict of MSHA's Rocky Mountain District, Metal and Nonmetal Mine Safety and Health, showed improved injury incidence rates.

One operation, the Anaconda Copper Co.'s Car Fork Mine at Toele, Utah, progressively reduced its injury rate in each of eight successive quarters during 1978 and 1979—from 57.36 to 13.90, a decrease of more than 75 percent—before rising slightly early this year. Remarkably, the two-year decrease was accomplished during a period in which the mine's workforce nearly doubled to about 840 employees.

James Ennis, the MSHA PAR investigator, attributed the progressive improvement to new management initiatives, including expansion of the safety department and audio visual, training and incentives programs.

In another PAR effort, conducted by Roy Maki, of MSHA's Moab, Utah, field office, the injury incidence rate at Atlas Minerals' Patti Ann Mine was reduced from 39.88 in 1978 to 5.86 in 1979.

PAR mines in MSHA's Northeastern District which improved their safety records included the Cohoes Mine and Mill, Cohoes, N.Y., whose incidence rate dropped from 39.27 in 1978 to 16.70 in 1979, and the Belle Mine and Bellefonte Mill, Bellefonte, Pa., whose incidence rate decreased from 17.50 in 1978 to 10.56 in 1979. Richard Duncan, the district's PAR coordinator, said that, although the latter mine no longer is in the program, MSHA is continuing to work with management and union representatives at the company's request to further improve safety practices.

In the Vincennes, Ind., Subdistrict of MSHA's North Central District, PAR inspector Robert Taylor reported excellent cooperation by management and the union at the Allied Stone Co.'s Quarry and Mill near Milan, Ill., during a 1979 program in which the injury incidence rate was reduced to zero (no lost-day injuries) from 22.28 the year before. At another operation in the district, the Nugent Sand and Gravel Mine, the incidence rate in 1978 was 54.89, compared to 7.53 in 1979.

Among PAR operation's in MSHA's South Central District, a successful program was conducted by James Ruble, of the Rolla, Mo., Subdistrict office, resulting in a 1978-79 reduction of from 12.30 to 4.87 in the injury rate. Cooperation by management and representatives of the

MSHA inspector Arthur Carisoza and Sara Kinert, supervisor of safety and personnel at the Crystal Silica Mine, near Oceanside, Calif., discuss the Program in Accident Reduction conducted at the mine. A 67 percent reduction in lost-time injuries was achieved at the operation during 1979.

United Cement, Lime and Gypsum Workers union, he said, was "excellent." Ruble also cited a clay company which has reduced lost-time incidents by more than 80 percent in six months.

Francis Csepregi, a PAR investigator with the Dallas Subdistrict field office in Albuquerque, N.M., directed a program at the Rio Puerco Mine, which had a 33.56 injury incidence rate for 1978, but was removed from the program midway in 1979 after the rate dropped to 5.62, well below the national average.

Last year, as in previous years, a minority of metal and nonmetal operations throughout the country showed little or no safety improvement under the Program in Accident Reduction. In some cases, the reasons have been clear; in others, they have been less obvious.

The records show that most managers and safety directors of PAR mines have, if sometimes reluctantly, accepted PAR at face value—as a useful safety tool—and have put it to good use. Others have given only token support to the program or, in a few cases, been openly hostile toward it. PAR investigators in field offices with small staffs sometimes have had to temporarily suspend PAR work at a mine to deal with serious immediate safety problems elsewhere. And it would be foolish to pretend that all PAR investigators are equally effective in presenting the program and enlisting company support. Management reorganizations, labor problems, and other complex factors have affected safety programs. And the quality of a mine's workforce also has been a consideration. Absenteeism is a serious problem at some mines. And experience levels of key supervisors and workers vary widely from one operation to another.

For whatever reason or combination of reasons, certain PAR mines have shown significant safety improvement only in their second or third years under the program. One such operation is the National Potash Co.'s Lea Mine and Refinery, near Carlsbad, N.M., which has been on the PAR list for much of the past three years.

(Continued on Page 27)

Selection of PAR Mines Based on Several Factors

The Mine Safety and Health Administration's Program in Accident Reduction (PAR) was created to offer professional safety assistance on a cooperative basis to those mining operations which accident and injury records have shown to have serious injury rates significantly above national rates for similar type mines. Generally, the first question asked by a mine manager who has been told that his operation has been designated for PAR involvement is, "Why me?" The selection process actually is both carefully considered and complex. It was developed by MSHA's Health and Safety Analysis Center. The following article discusses criteria for selecting mines for special attention.—The Editor.

By John Kogut
Chief, Branch of Statistical Support Forecasting
MSHA Health and Safety Analysis Center

In developing criteria for selecting and designating certain of the Nation's mines for special attention, a number of factors have been considered. The criteria, first used by MSHA in Fiscal Year 1978, take into account:

- The rate of lost-workday injuries at the mine, adjusted for random fluctuations due to mine size;
- The relative severity of the type of injuries experienced at the mine;
- Differences in policy regarding "light duty" and the time off work at different mines;
- The number of lost-workday injuries experienced at the mine, beyond what would be expected if the mine adhered to the national norm;
- The trend, if any, of consistent improvement or deterioration in the mine's lost-workday injury experience, relative to a national norm.

The first three considerations are combined in an index called the "Extended Injury Index" (EII). Considerations 4 and 5 are combined in a one-year projection of the "surplus" number of lost-workday injuries, based on a continuation of past trends.

The Extended Injury Index provides a way of ranking all mines, regardless of size or type, by estimating their overall level of injury hazard. Since some mines experience injuries that tend to be more serious than those at other mines, the index is formed by first applying a weighting factor to each reported lost-workday injury. The weighting factor is proportional to the national average number of days lost for injuries of that type. (In computing this average, fatalities and permanent injuries are assigned a fixed number of days lost, in accordance with the American National Standards Institute standard).

The national average is used, rather than the actual number of days lost at the mine, in order to compensate for local differences in lost-time policy. The weighted

(Continued on Page 28)

THE PROGRAM IN ACCIDENT REDUCTION [PAR] FOR METAL AND NONMETAL MINES, FY 1976 THROUGH 1979

FY 1976 PROGRAM

	33 operations in PAR program			All other U.S. metal and nonmetal mines and mills		
	FY 1975	FY 1976	Percent change	FY 1975	FY 1976	Percent change
Fatalities	15	5	-67%	108	108	0
Disabling injuries[1]	1772	1290	-27%	6772	7308	+8%
Fatalities per million employee hours	0.49	0.17	-65%	0.28	0.26	-7%
Disabling injuries per million employee-hours	57.58	44.76	-22%	17.42	17.61	+1%

1977 PROGRAM

	48 operations in PAR program			All other U.S. metal and nonmetal mines and mills		
	1976	1977	Percent change	1976	1977	Percent change
Fatalities	8	7	-12%	105	127	+21%
Disabling Injuries	1818	1183	-35%	6780	7609	+12%
Fatalities per million employee-hours	0.23	0.22	-4%	0.26	0.31	+19%
Disabling injuries per million employee-hours	52.19	36.89	-29%	16.57	18.33	+11%

1978 PROGRAM

	64 operations in PAR program			All other U.S. metal and nonmetal mines and mills		
	1977	1978[2]	Percent change	1977	1978	Percent change
Fatalities	15	5	-67%	119	131	+10%
Lost-day injuries (NFDL)[3]	1880	1698	-10%	8150	9729	+19%
Fatalities per 200,000 employee-hours[4]	0.10	0.03	-70%	0.06	0.06	0
Lost-day injuries per 200,000 employee-hours	12.31	10.49	-15%	3.91[5]	4.66	+19%

1979 PROGRAM

	60 operations in PAR program			All other U.S. metal and nonmetal mines and mills		
	1978[2]	1979[6]	Percent change	1978[2]	1979[6]	Percent change
Fatalities	8	5	-37%	128	117	-9%
Lost-day injuries (NFDL)	2269	1896	-16%	9158	10883	+19%
Fatalities per 200,000 employee-hours	0.05	0.03	-40%	0.06	0.05	-17%
Lost-day injuries per 200,000 employee-hours	15.24	11.82	-22%	4.07	4.50	+11%

NA = Not available

[1] Defined as injuries that caused one or more days' absence from work, including fatalities.

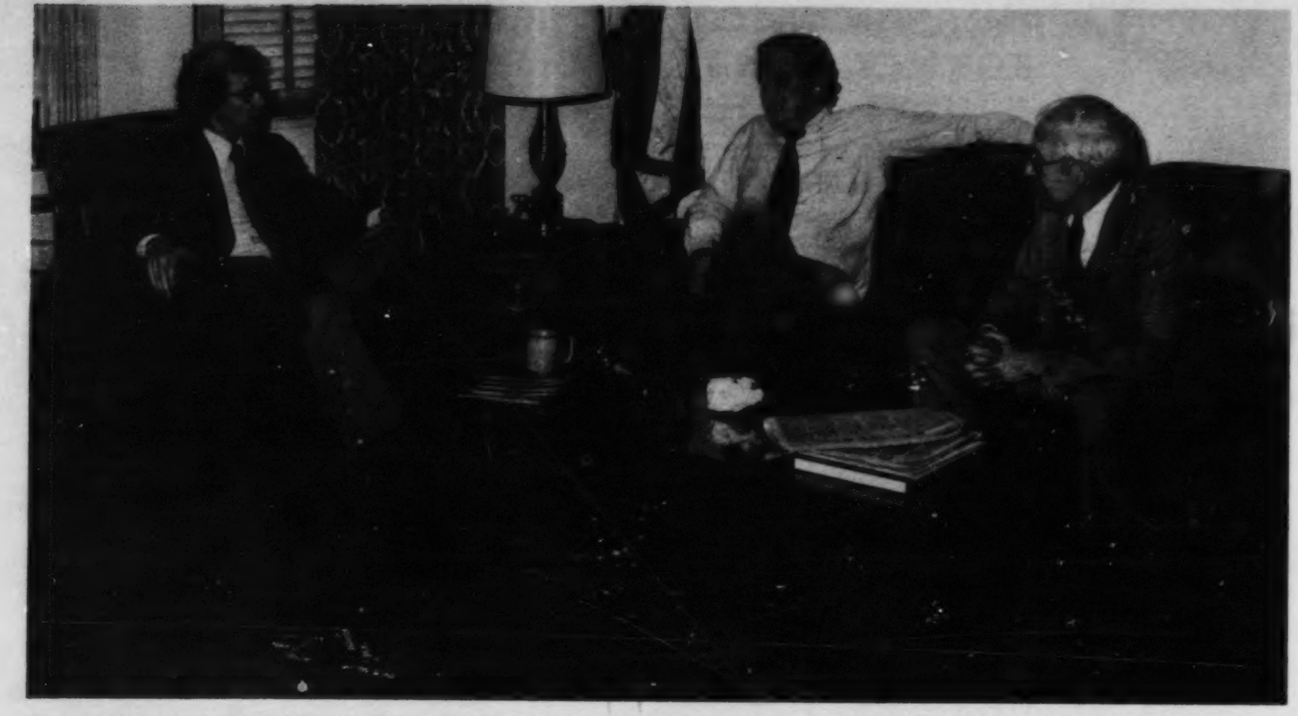
[2] Preliminary figures.

[3] Under a revised injury classification system, adopted in 1978, nonfatal injuries are classified as Nonfatal occurrences with Days lost (NFDL) and No Days Lost (NDL). The NFDL is not equivalent to the former category of disabling injuries (see footnote 1) because it includes cases where a miner was assigned to light duty for one or more shifts. The 1977 injuries at program operations were re-evaluated according to the new classification. However, the 1977 injuries for the rest of the metal and nonmetal mines and mills were not re-evaluated; the figure of 8150 lost-day injuries shown is estimated, based on proportion of injuries assigned to light duty work in 1978.

[4] A base of 200,000 employee-hours for injury rates was adopted in 1978.

[5] Computed from the estimated number of lost-day injuries.

[6] Projected data, based on January-September 1979 figures.



First convened in October 1978, the Federal Mine Safety and Health Review Commission has issued final orders and decisions in a majority of the 174 cases that have come before it as of early April this year, including some cases involving widely divergent interpretations of the Federal Mine Safety and Health Act of 1977, under which the commission was created. Above, left to right, Dennis Clark, commission general counsel, and Commissioners Richard V. Backley and A. E. Lawson discuss a pending case.

Independence, Consistency Stressed As Role of Commission Develops

By Ralph Lewis
Assistant Editor, Mine Safety and Health

When the presidentially-appointed members of the Federal Mine Safety and Health Review Commission (FMSHRC) assemble in their Washington, D.C., hearings room each week, they often bypass their nameplated positions behind a massive, elevated bench in favor of folding chairs that surround a small conference table just a few feet away. "Too hard to turn sideways and talk to each other up there," Commissioner Richard V. Backley recently said, "and besides, it would be difficult for people to hear us down in front."

Frequently, the commission meetings are public even though the "Sunshine Act", legislation that requires certain government agencies to hold "open" meetings, does not cover such adjudicatory sessions. The commissioners also are reportedly accessible to members of the press, they enjoy making occasional forays into the field to talk to mine industry and labor groups, and, they often speak kindly of one another. By some definitions, they might hardly be considered a traditional judicial panel, but then again, they probably would not want it that way.

"We're a new kind of tribunal—one with a special mission," said Frank J. Jestrab, one of the four current commissioners. "It is imperative that we administer this compassionate statute fairly . . . and gain the confidence of MSHA, industry, labor organizations and the miners themselves. That's our transcendent responsibility."

Since they first officially met in October 1978, members of the commission have been resolving disputes arising under enforcement of the Federal Mine Safety and Health Act of 1977, and, it seems, they are developing a sense of their own role as they believe Congress intended it to be. This perception is reflected in many of the final orders and decisions issued on 98 of the 174 cases that have come before the commission as of early April this year.

In fiscal year 1979, mine operators, miners and their representatives submitted nearly 5,000 requests for disposition on which there were about 2,800 decisions by administrative law judges (ALJ's). To date, over 120 appeals, known as "petitions for discretionary review (PDR's)", have been filed with the commission, and of those, 85 have been granted. The commission also inherited 89 cases that were before the Department of

Interior's Board of Mine Operations Appeals (IBOMA), the review body under the 1969 Coal Mine Act, and so far, there have been 45 commission decisions or orders on those.

In other work, the commission issued final procedural rules in June 1979, and in October that year, opened a Denver, Colorado office with four new administrative law judges. Former Commission Chairman Jerome Waldie resigned in December 1979 to chair the White House Conference on Aging, and, since a fifth commissioner has not yet been appointed to fill the vacancy, the chairmanship is rotated monthly among the remaining four, Richard V. Backley, Frank J. Jestrab, A. E. Lawson and Marian Pearlman Nease. Even with the possibility of a split decision, none of the commissioners appear worried that a standoff could occur.

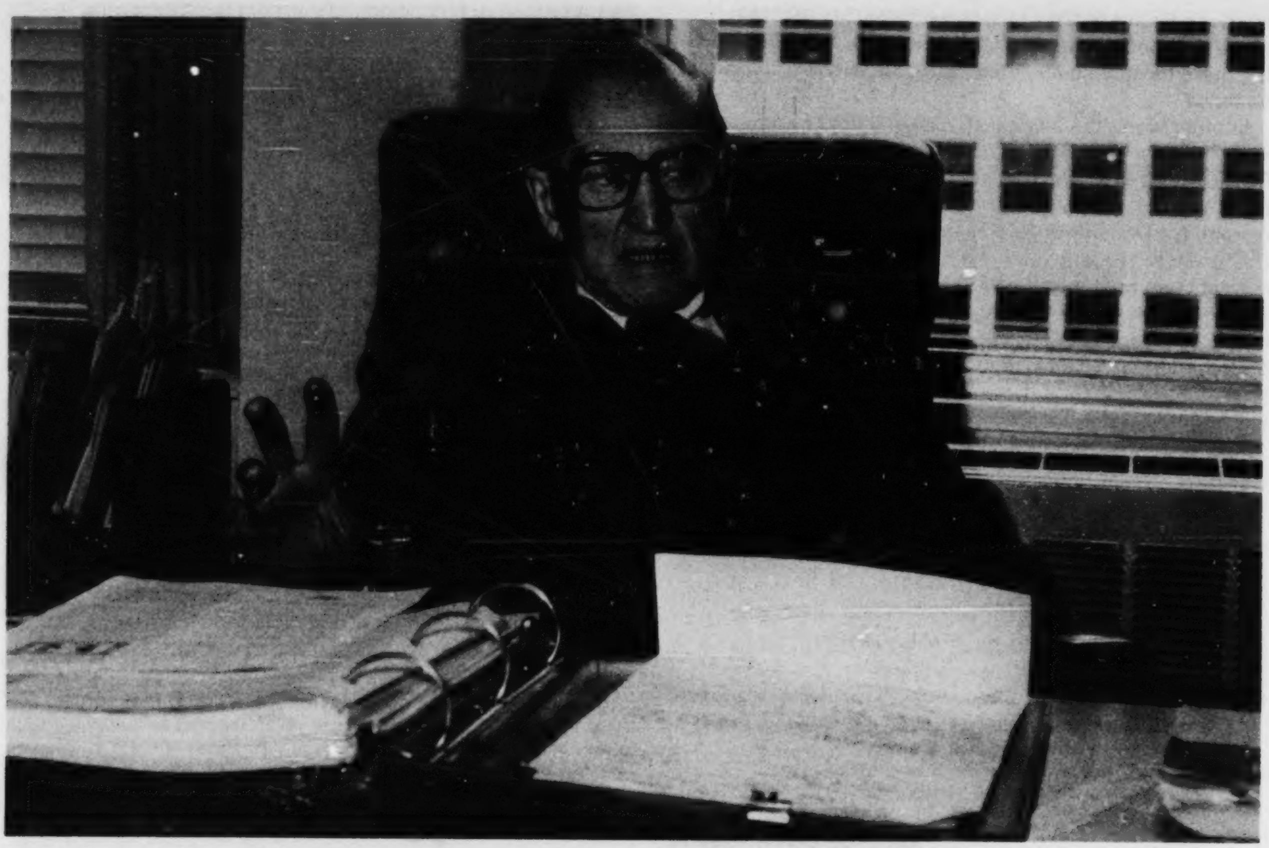
"Right now we are interested in building a body of law while maintaining a degree of consistency," Lawson said. "Our administrative system has lent itself to this, I believe. Our productivity has also been good, and I think at this point that we're all in rough agreement on just what the issues are."

Under the 1977 Act, anyone "adversely affected or aggrieved" by an ALJ decision may file a petition for discretionary review with the commission within 30 days of that decision on one or more of the following grounds; 1.) A finding or conclusion of material fact is not supported by substantial evidence, 2.) A necessary legal conclusion is erroneous, 3.) The decision is contrary to law or to the duly promulgated rules or decisions of the commission, 4.) A substantial question of law, policy or discretion is involved, 5.) A prejudicial error of procedure was committed.

When filed, a petition is first reviewed and analyzed by Dennis Clark, general counsel, and his staff of 10 attorneys who then compile an in-depth memorandum outlining the views of the ALJ, the petitioner and other parties involved. The memo is examined by the commissioners and their personal counsels, and, during regular meetings, it is determined whether or not the petition should be granted. If accepted, the case is researched by the general counsel's staff and by the commissioners and their counsels, a decisional meeting is held, and a proposed opinion which is drafted by the general counsel is circulated among the commissioners for changes. The final decision, written in consensus form, "reflects more of an institutional view," Clark said.

Roughly fashioned along the same lines as the Occupational Safety and Health Review Commission (OSHRC), the review body established in 1970 to handle OSHA cases, the FMSHRC has several administrative differences. Initially, the OSHRC had separate counsel staffs for each of its three commissioners, a setup that some-

Nease: "Right now, it is a matter of establishing some clear formulas and definitions, and I think we are all aware of the need to develop a well-defined body of law."



Jestrab: "Our aim is to read the statute . . . insist on the independence of the administrative law judges, and decide as fairly in accordance with the statute as we can. The question of whether miners' representatives should receive pay on spot inspections has probably been our biggest area of disagreement . . ."

times produced problems, Clark said. Based on the OSHRC experience, a central general counsel's office was established within the FMSHRC, a move later adopted by the OSHRC after the FMSHRC had been in operation for about a year. Under this system, Clark said, the counsel staff is less prone to slant the issues to the viewpoint of any one commissioner and cases can be rapidly processed.

"The general counsel creates a more neutral product—one that acquires more credibility," Lawson recently said. "We still have our personal prejudices and don't rubber stamp the general counsel's product, but the system is conducive to fairness and isn't result-oriented."

Jestrab sees another advantage. "With five members rather than three, we have more checks, more flexibility, and more viewpoints to take into account," he said. "Very often our opinions are a product of compromise, where people have subordinated some of their personal opinions in the interest of unanimity."

Even so, there have been a few dissensions among the commissioners in major cases in the last several months. The most pronounced split of opinion came in a decision regarding whether miners' representatives who accompany MSHA inspectors on so-called "spot" inspections under the "walkaround" provisions of the 1977 Act are entitled to compensatory pay. The decision on the case, *The Secretary of Labor (MSHA) v. The Helen Mining Company* (Docket No. PITT 79-11-P), was signed in late November 1979 by Waldie, Backley and Nease.

The intent of Congress, they said, was to afford compensatory pay only to miners' representatives who accompanied MSHA inspectors on regular inspections. Lawson and Jestrab disagreed. Had the case been decided by the commission after Waldie's resignation, it is possible there might have been an even split.

"It is imperative that we administer this compassionate statute fairly . . . and gain the confidence of MSHA, industry, labor organizations and the miners themselves. That's our transcendent responsibility."

Despite the divergent views on the central issue of the Helen Mining case, there apparently was agreement on the commission's own adjudicatory function. "Philosophically, how the commission perceives itself is embodied in a statement in the Helen decision," Clark said. "It reflects, I believe, that the commission is more than just a disinterested court—more than an arbitrator. It is, as we see it, charged with implementing the purposes of a particular statute."

The facts of the case were not in dispute. On April 6, 1978, a MSHA inspector interrupted a "regular" inspection at the Helen Mining Co.'s Homer City Mine near Johnstown, Pa., to conduct a "spot" inspection under section 103(i) of the 1977 Act, which requires that an inspection be conducted at least once every five days at irregular intervals at mines that liberate excessive quantities of methane.

Before the inspection, the MSHA inspector notified the mine's safety director and miners' representative, and the safety director told the representative that the company would not pay him for the time spent accompanying the MSHA inspector. Thinking that his union would compensate him, the miners' representative participated in the inspection. Payment for the three hours was not included later on his paycheck. After the miners' representative informed MSHA, the inspector issued a citation under section 104(a) of the 1977 Act claiming that a violation of the "walkaround rights" provision, section 103(f), had been committed. When the company continued to refuse to pay the miners' representative, the inspector then issued an order under section 104(b) of the 1977 Act for failure to abate.

The Secretary of Labor then went to the commission seeking the assessment of a civil penalty against the company for the alleged violation and a hearing was held before Assistant Chief Administrative Law Judge Paul Merlin. The Helen Mining Co. argued that this particular inspection fell under section 103(i) of the 1977 Act, and since section 103(f) required "walkaround" pay only for inspections "made pursuant" to section 103(a), no violation had occurred.

The Secretary argued that although the inspection was not covered specifically in section 103(a), it was made for the purposes written in the first sentence of the section, "determining whether an imminent danger exists." Judge Merlin agreed with the company, the Secretary filed a petition for discretionary review with the commission, and oral argument was held in late July 1979.

The biggest problem, it seemed, was the meaning of the statutory language itself. The key phrase, one that the commission's decision said was "ambiguous and does not clearly favor either position," was the one in section 104(f) allowing for walkaround rights "during the physical inspection of any coal or other mine *made pursuant to* the provisions" (emphasis added) of section 103(a).

Several specific types of inspections were required in other sections of the 1977 Act, the commission's decision said, but the only type of inspection specifically referred to in section 103(a) was the regular, mandatory inspection. Even if the other clauses in section 103(a) encompassed other kinds of inspections, as the Secretary had argued, the decision said, "one could still reasonably believe that the phrase . . . in section 103(f) was intended to accord the right to walkaround pay to the inspection specifically and exclusively described in section 103(a)—the regular inspection."

On the other hand, there were problems with the company's arguments, the commission found. The company conceded, the decision said, "that if its construction of the statutory language is followed, miners would have no right to accompany inspectors even without pay in other than regular inspections . . . We share grave doubts that this is what Congress intended."

Lawson: "Our productivity has been good, and I think at this point that we're all in a rough agreement on just what the issues are."

To discover what they thought Congress did indeed intend, the commissioners delved into the legislative history of the 1977 Act. The original House and Senate bills had differed considerably on the issue, but a statement by Rep. Carl Perkins (D. Ky.) clarified the intent, the majority of commissioners said. Following the agreement of the House and Senate conferees on the legislation, Perkins, the chief House conferee, spoke before the House. In part, he said, ". . . the intention of the conference committee is to assure that a representative of the miners shall be entitled to accompany the Federal inspector, including pre- and post (inspection) conferences, at no loss of pay only during the four regular inspections of each underground mine and two regular inspections of each surface mine in its entirety . . ."

Relying on this statement, calling it "the only passage in the legislative history that speaks specifically to this question and clarifies an ambiguity . . ," the majority of commissioners affirmed Judge Merlin's decision. In his dissent, Jestrab also turned to legislative history to support his view that the "frequent inspections" mentioned in section 103(a) were, in effect, mandatory statutory inspections that included, among others, the "spot" inspection required under section 103(i).

Citing several case histories to prove his point of law, Jestrab said that "these sections of the Mine Safety Act serve a broad, remedial purpose, and as such should be given a liberal construction . . ." Lawson, in his dissent, agreed with the Secretary's argument that, "simply because a type of inspection is specifically treated in another provision of the Act, does not mean that it is outside section 103(a)." He disagreed that the language was "ambiguous" and that the statement of Rep. Perkins reflected the overall Congressional intent.

The Secretary of Labor obviously disagreed with the commission's decision, and, in early December 1979, filed an appeal with the U.S. Court of Appeals for the District of Columbia Circuit.

Joseph O. Cook, MSHA Administrator for Coal Mine Safety and Health, said in a December memorandum that

Backley: ". . . We have to look at the views of all parties, interpret the statute, and, if that requires touching on policy matters that affect enforcement, well then, okay."

inspectors should issue a citation to an operator who refuses to allow a miners' representative to accompany the inspector during any inspection—but miners' representatives will be compensated only when accompanying an inspector on a so-called "regular" inspection.

Despite their dissents in the case, Jestrab and Lawson apparently agree with the majority on the commission's role in settling such disputes. The issue had been raised before in a case involving the liability of mine operators for violations committed by independent contractors under the 1977 Act, and Jestrab and Lawson agreed with the majority. Though Backley dissented, he recently said that he "completely agreed with the majority when it came to such policy matters."

The commissioners' self-examination in the Helen Co. decision came in response to an argument by the Secretary that said Judge Merlin had not given "proper deference" to MSHA's interpretation of the "walkaround rights" provision of the 1977 Act. Citing another case, the Secretary said that "review is guided by the considerable deference traditionally owed the interpretation of a statute by the head of the agency charged with its administration," and, in reference to a Supreme Court case, argued that, "the construction of a statute by those charged with its execution should be followed unless there are compelling indications that it is wrong . . ."

The commissioners disagreed. "Under the Secretary's view," they said in the decision, the commission's task "would be little more than to find the facts, accord considerable deference to the Secretary's position, and determine whether there are compelling indications that his construction of the 1977 Act is wrong." The cases cited by the Secretary were not pertinent, they said, because they dealt with "the deference that federal courts often accord to those administrative agency heads who alone have been entrusted by Congress with all administrative and policy functions under a statute." Since, in the commission's view, the 1977 Act divided these functions between the Secretary and the commission, the commission "is not entirely in the position of a court and the Secretary is not in the position of most agency heads" in this area, the decision said.

The commissioners then dipped into the legislative history to examine the relationship between the two agencies that Congress had intended to establish. A Report of the Senate Subcommittee on Labor, Committee on Human Resources, on the final Senate version of the mine safety and health bill appeared to answer the question, saying in part, ". . . it is the intention of the committee, consistent with generally accepted precedent, that the Secretary's interpretations of the law and regulations shall be given weight by both the commission and the courts."

The commission's decision said it would give "special weight to the Secretary's view of the 1977 Act," particularly in areas where the Secretary had "gained some special, practical knowledge . . ," but the degree of deference requested by the Secretary in this case was above what Congress had intended since the issue at hand was "one of statutory interpretation," the commission's "primary role."

"We're not trying to second guess the Secretary," Nease recently said, "we're just simply trying to review whether or not they are consistent with policy. Right now it is a matter of establishing some clear formulas and definitions, and I think we are all aware of the need to develop a well-defined body of law."

> *"We still have our personal prejudices and don't rubber stamp the general counsel's product, but the system is conducive to fairness and isn't result-oriented."*

Backley, a former assistant solicitor with the Interior Department's Division of Mine Health and Safety before that division was transferred to the Department of Labor upon passage of the 1977 Act, recently emphasized the independence of the commission. "The Secretary has a tough job, one that I think has been handled well," he said. "I agree, of course, that the Secretary's views should be given weight by the commission, particularly in areas where he might have an expertise that we lack. Even so, we have to look at the views of all parties, interpret the statute, and if that requires touching on policy matters that affect enforcement of the 1977 Act, well then, okay."

"The whole question of the adjudicatory and policy function," Jestrab said, "is one that has been argued for many years. Really all we do is adjudicate, and questions of policy in the broad sense should be set by Congress. Our aim is to read the statute as passed by Congress, insist on the independence of the administrative law judges, and decide as fairly in accordance with the statute as we can."

"The question of whether miners' representatives should receive pay on spot inspections has probably been our biggest area of disagreement," Jestrab said, "and it is possible the question may go as far as the Supreme Court." On another "walkaround" rights decision, there were no dissents. This and some of the commission's other major decisions are summarized below:

- **Magma Copper Co. v. Secretary of Labor, FMSHRC Docket No. DENV 78-533-M, decided Dec. 10, 1979.** The commission reversed an administrative law judge's decision which said that only one miners' representative could receive compensatory pay when two miners' representatives accompanied two separate groups of MSHA inspectors engaged in a regular inspection under section 103(a) of the 1977 Act. "The literal words of a statute may not be the best guide to the legislative purpose when they appear to conflict with the congressional purpose for creating a right or produce a result that is illogical," the commission's decision said. The decision has been appealed by Magma.
- **Energy Fuels Corp. v. Secretary of Labor, FMSHRC Docket No. DENV 78-410, decided May 1, 1979.** The commission decided that a mine operator can immediately contest a citation issued by MSHA instead of having to wait until notification by the Secretary of the proposed penalty. Lawson dissented.
- **Secretary of Labor v. Cut Slate, Inc., FMSHRC Docket No. WILK 79-13-P, decided July 25, 1979.** The commission held that an administrative law judge "abused his discretion" by defaulting a mine operator for failing to attend a prehearing conference on a penalty assessments case at a location which was an unreasonable distance from the operator's location of business. The commission reversed the case and remanded it back to the administrative law judge for further proceedings.
- **Secretary of Labor v. Old Ben Coal Co., FMSHRC Docket No. VINC 79-119, decided Oct. 29, 1979.** The commission affirmed an administrative law judge's decision that a mine operator can be held liable for violations committed by an independent contractor. Backley dissented. This decision has been appealed by Old Ben.
- **Secretary of Labor v. Jim Walter Resources, Inc., and Cowin and Co., FMSHRC Docket No. BARB 77-266-P and BARB 77X465-P, decided Nov. 21, 1979.** The commission reversed an administrative law judge's decision that dismissed a civil penalty assessments case against a mine operator because the notice of violation was not specific enough to satisfy the requirements of section 104(e) of the Federal Coal Mine Health and Safety Act of 1969. Lack of specificity in a notice of violation does not alone "render the notice invalid," the commission said.
- **Secretary of Labor v. Old Ben Coal Co., FMSHRC Docket No. VINC 74-11, IBOMA 75-52, decided Dec. 12, 1979.** Following a decision by the old IBOMA on this case, the United Mine Workers of America filed a petition for appeal with the Court of Appeals for the District of Columbia Circuit. After passage of the 1977 Act, the Court remanded the case to the FMSHRC. The commission reversed the IBOMA's decision, holding that a standard is violated even if a mine operator is aware or not of an accumulation of coal dust or whether the operator has begun a clean up effort within a "reasonable time."

"These decisions reflect, on a case-by-case basis, that the 1977 Act is a tough statute," Dennis Clark said. "Since the Act is designed to induce operators to make all efforts to minimize liability, and since MSHA can't be in every mine 24 hours a day, it is a statute largely dependent on self-enforcement. If the operators think the system is fair, they'll have added incentive for compliance."

"Mine safety, as I see it," Jestrab said, "is a long educational process that doesn't just happen overnight. The 1977 Act is a good, compassionate statute, and, if we handle it professionally, and we gain the confidence of MSHA, industry, labor and the miners, we will have accomplished our mission."

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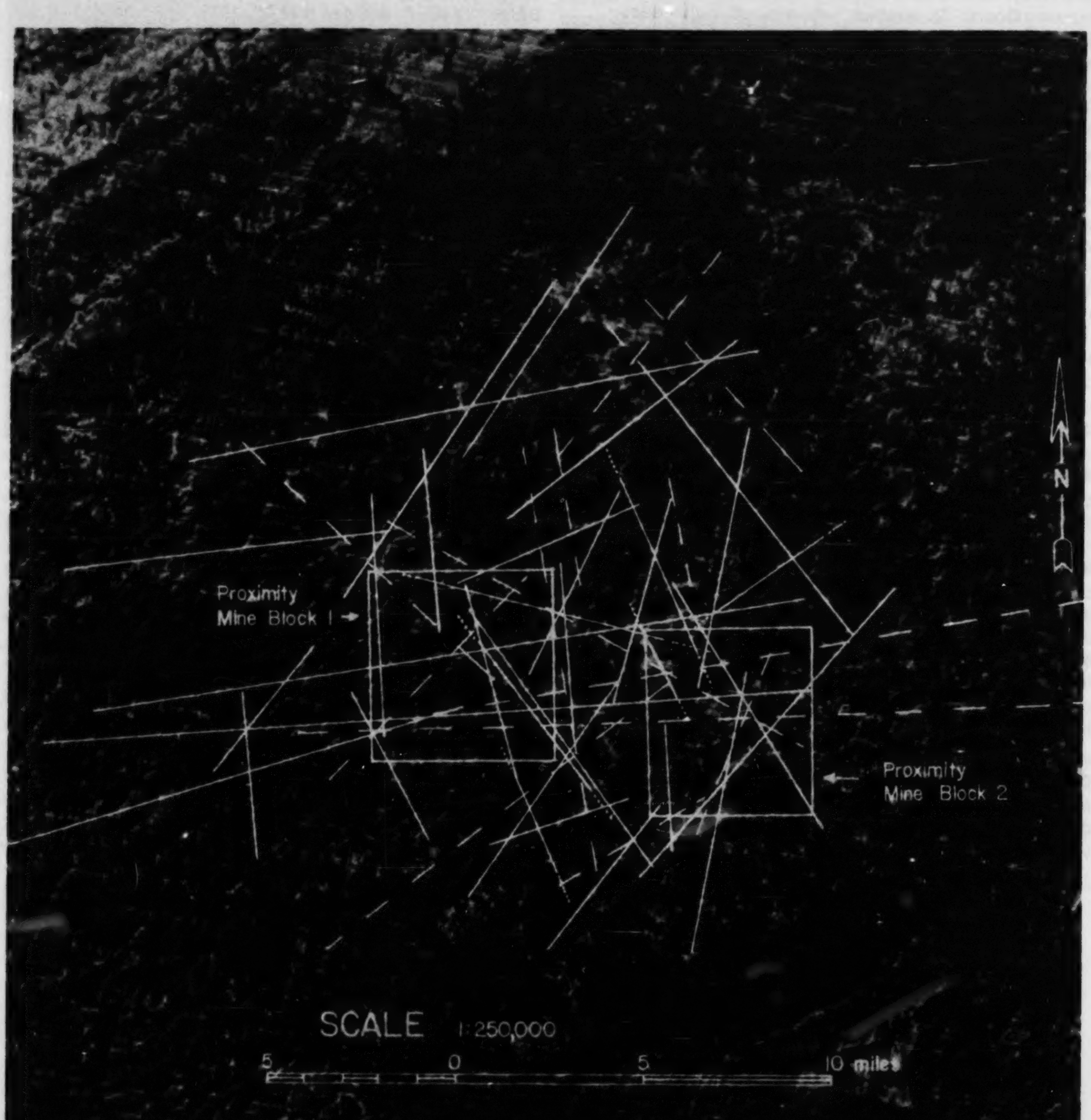


Photos made by satellites orbiting the earth are being used to locate geologic irregularities that may indicate fractures or fault systems which could result in underground mine roof falls. Here, linear geologic features have been marked on a satellite photograph covering the area of an underground mine. Intersecting "linears" indicate areas of greatest danger from roof falls.

More Mines Make Use of Satellite Imagery as a Roof Control Tool

By Debra Howerton
MSHA Staff Writer

What used to be no more than a vague possibility discussed in hypothetical terms by a handful of experts is rapidly becoming a practical mine safety tool.

Remote sensing through analysis of satellite imagery for detecting potential problems related to unstable mine roof condition is used today by hundreds of mining companies throughout the United States. And evidence of the concept's progress since its introduction to mining five years ago is the training being conducted by the Mine Safety and Health Administration (MSHA) for its enforcement personnel.

Offered at the MSHA technical support centers in Pittsburgh and Denver, the training aims to educate all MSHA safety professionals in the application of remote sensing to mine safety. MSHA hopes to make known to the mining industry—coal and metal/nonmetal, underground and surface—its capability to help them use remote sensing techniques in solving ground support or roof control problems.

How does it work? Briefly, imagery taken by satellites orbiting the earth is obtained commercially from the Earth Resources Observation Systems (EROS) data center in Sioux Falls, S.D. Analyzing the imagery of a particular geographic area, a trained observer can identify and plot on a photograph geologic irregularities, or "linears," indicative of fractures or fault systems which could result in falls of ground that kill or injure miners.

Satellite imagery is not new, but its mining-related use is. However, Ed Hollop, chief of the ground support branch at MSHA's Technical Support Center, says it is gradually gaining acceptance as technological expertise improves and mine operators see its value in predicting ground instability.

"Remote sensing constitutes about 20 percent of the work in this branch," Hollop says. With $50,000 worth of equipment and two full-time geologists devoted to the program, calls come in daily from operators requesting mine evaluations. Hollop estimates that the two technical support centers have completed more than 400 such analyses.

"In accepting requests, we follow the same procedure as in any other inspection action," he explains. "Either the inspector calls and says he needs us to do an evaluation, or the company calls and requests one. So far our predictions have been pretty accurate."

With so many mines interested in remote sensing, MSHA's current thrust is to put all of its inspectors through beginning, intermediate and advanced training before the end of the year.

The first three-day introductory course, conducted in Pittsburgh in February, included fundamentals of the satellite program; how-tos for ordering imagery from EROS; basic geology—from rock identification to definitions of geologic terms; geophysics; and a hands-on session in use of the spatial data system and other analysis equipment.

Thomas Buelow, a mining engineer with MSHA's Coal Mine Safety and Health District 8, Vincennes, Ind., left, tries his hand at stereoscopic analysis of satellite photos as Robert O'Neil, mine inspector from District 3, Morgantown, W.Va., and Ron Valane and James Kramer, of MSHA's roof control branch, Bruceton, Pa., view satellite imagery on a lighted screen. MSHA is expanding its program to train inspectors in remote sensing techniques used to identify geologic irregularities that could cause roof problems in underground mines.

"We covered a great deal of material and covered it quickly," Kirk McCabe, geologist from the Pittsburgh roof control branch, says. "It was strictly an introductory session to expose them as much as possible."

MSHA personnel attending the session came from a variety of experience levels. One West Virginia coal mining district became involved with remote sensing three years ago in an attempt to solve a particular mine's roof control problems. It now reports that two-thirds of its mines have been plotted and analyzed using satellite imagery.

"We have our own geologist who plots about 10 mines a month, and hope to have all the mines in our district plotted by the end of the year," Bob Crumrine, technical specialist from MSHA's Coal Mine Safety and Health District 3 in Morgantown, W. Va., says. To a representative from a western district, however, the session was a first exposure to satellite imagery and remote sensing.

However simple the process may seem, MSHA's remote sensing experts want to make clear to potential users in the mining community how to make use of satellite imagery in promoting safer mining at their operations.

The first step is finding out what is available for a particular area by filling out a "Geographic Computer Search" form, specifying the latitude and longitude of the mine and type of coverage desired.

Robert Stahl, a geologist with MSHA's Technical Support Center in Denver, peers through a three-dimensional stereoscope at satellite photos of the earth. Analyses of satellite imagery and conventional aerial photographs have proven useful in detecting potentially unstable underground mine roof conditions.

Bob Stahl, geologist from Denver Technical Support, recommends requesting Landsat imagery, photographed from 570 miles up; Skylab imagery, taken from 235 miles above the earth; NASA U-2 imagery from 60,000 feet; and finally conventional aerial photographs from an altitude of two or three miles. Preferred time of the year, maximum acceptable cloud cover and minimum acceptable quality rating must also be specified according to individual needs. Within a few weeks the EROS data center responds with a computer printout reporting all available imagery. From this, imagery of areas covering certain mines may be ordered.

"I suggest ordering film positives for about $10 each. Some basic equipment—a 10x magnifier, folding stereoscope and small light table—plus the imagery costs about $300," Stahl says. "Operators don't realize they can get a lot of information very inexpensively. It's there . . . it's just a matter of extracting it."

Imagery analyses do vary according to the way they are interpreted. Some linears, which are plotted as lines on the photograph and may indicate areas of potential instability, could represent something of a non-geological nature, Stahl explains. "It may be that only 80 percent of the linears shown on a transparency are valid. They could be buried pipelines or old cow paths. That's why we have to do 'ground truthing'—go out and verify that what we see are actually variations in rock structure."

The future of the application of remote sensing to mining looks optimistic. Its applications are being used or considered for both existing and newly planned mines in mine projections design, ventilation design, early hazard warning, mining method and equipment selection, roof control planning, shaft and slope location; and mine portal location.

MSHA districts have already begun to see the benefits of their remote sensing programs. For example, in Republic Steel Corp.'s Kitt No. 1 Mine in West Virginia, roof conditions had been excellent through nearly 1,500 feet of eastward development, when a major fall occurred. Pittsburgh's roof control branch had previously plotted a linear at the approximate location of the fall; and as a result, the mine's chief engineer had alerted the section to increase roof support. The sole miner in the area at the time of the fall ran at the first sound from the roof 10 seconds before it fell. He later said that, without the engineer's warning, he would not have been aware of the problem roof, and probably would not have escaped.

Another example of the program's practical use was in an underground mine in southern Utah, where a continuous miner was buried in a cave-in. An evaluation of the area revealed that the problem resulted from faults in the mine.

In response, the company had defined areas of potential hazard noted on a lineation map. Weekly section maps are provided to the shift boss and foreman, alerting them to take extra precautions, such as installation of additional roof supports in areas of intersecting linears where the potential hazard may be greatest.

Although MSHA has previously relied on imagery from Landsat and Skylab satellites, improved imagery may soon be available. If approved by Congress, the first satellite to photograph the earth in stereo may be launched by the U.S. Geological Survey through NASA in 1985. The satellite will take sets of "stereopairs"—or two photographs at oblique angles which reveal a three-dimensional view of the earth when viewed through a stereoscope.

"Remote sensing has been around for a long time. But this is the first time we've been able to take the technology and use it to improve safety in mining," Stahl says. "It's not a cure-all, but our function is to provide training and get the word out that it is an effective mine-planning tool."

The Geographic Computer Search Form and other forms can be obtained from: NCIC Headquarters, U.S. Geological Survey, 507 National Center, Reston, Va. 22092, (703) 860-6045; or EROS Data Center, U.S. Geological Survey, Sioux Falls, S.D. 57198, (650) 594-6511.

For further information, interested persons may contact Ed Hollop, chief, Ground Support Branch, Denver Technical Support Center, P.O. Box 25367, Denver Federal Center, Denver, Colo. 80225, (303) 234-4905; or Anthony Zona, chief, Roof Control Branch, Pittsburgh Technical Support Center, 4800 Forbes Ave., Pittsburgh, Pa. 15213, (412) 675-6904.

Francis B. Janaszek, president of Western Pennsylvania Aggregates, checks guards on his conveying system called to his attention during a compliance assistance visit.

Metal/Nonmetal Mines Request Aid Under New CAV Program

More than 700 inspections have been completed as of early April under the Mine Safety and Health Administration's new Compliance Assistance Visit (CAV) program, which provides for inspections of certain metal and nonmetal mines without penalty assessment.

At the operator's request, MSHA now makes courtesy inspections of: new mines not yet producing; seasonal, closed or abandoned mines prior to reopening; and new facilities or equipment in operating mines.

The program was developed in answer to needs voiced by the mining industry during oversight hearings before the House Committee on Education and Labor last October.

According to Michael Trainor, manager of MSHA's Northeastern District, the complaints were primarily from small, seasonal operators who said they were willing to comply with the Act, but felt that MSHA should provide consultative services to ensure uniformity in interpreting the standards.

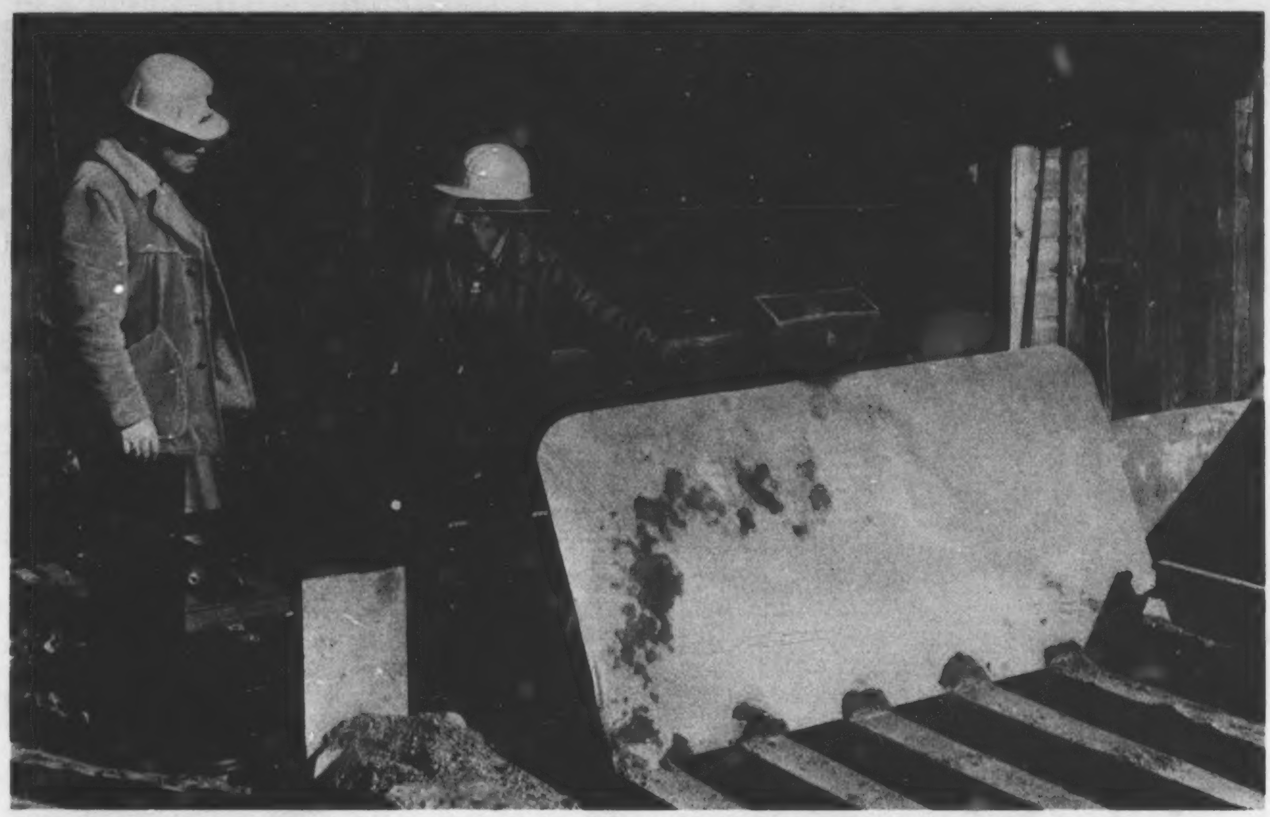
"The program, so far, is improving communications between inspectors and operators which allays fears and suspicions many operators have," Trainor said. "We assure them we are doing this to help them avoid a citation. The program is directed toward our common goal—health and safety in the mines."

CAVs are conducted in addition to the four annual underground mine inspections and two annual surface mine inspections mandated by the Federal Mine Safety and Health Act of 1977, during which assessment of penalties for violation of standards or regulations is authorized.

In contrast, compliance assistance visits authorize non-penalty notices of violation to alert the operator of potential violations or imminent danger situations. Since the visits are carried out prior to a mine's regular production season, the operator is given the opportunity to correct potential violations before opening.

"This program is the best thing that's ever happened to us. I'm one hundred percent for it," said Richard McFarland, superintendent of Plain Grove Sand and Supply Pit in Pennsylvania. "It's better than getting cited for violations, or having to stop operation and stand around while something is being fixed."

Since the program's beginning last November, MSHA's



James Hamed, right, superintendent of Mahoning Valley Pit and Plant in New Castle, Pa., and MSHA supervisory inspector Andrew Nawa, examine the grizzly on a crusher.

six metal and nonmetal districts report gradual but consistent monthly increases in requests from eligible operators. District managers feel that operators must be given time to adapt to the new program before complete acceptance can be expected. Thus, the emphasis in the past few months has been on getting the word out.

In addition to the initial letters sent to all active and inactive operations, MSHA's Northeastern District, for example, has conducted a series of workshops introducing the program and explaining its purposes. The Southeastern District has distributed bulletins in English and Spanish to clearly explain the program and its qualifying criteria. The primary means of communication, however, has been by word of mouth—the inspector sitting down with the mine superintendent or manager and discussing the program.

"When the inspector came for the CAV, we went from one end of this plant to the other and he wrote our 11 notations of potential violations," McFarland stated. "Now, if I don't have these fixed before I start operating, I deserve to get cited."

Small, intermittant operations are not the only mines which benefit from CAVs. Trainor noted that, after installation of a new crusher or conveyor system, for example, it is advantageous to have the equipment inspected to make sure it complies with MSHA standards and regulations.

"We also hope all CAVs are broad enough to include safety discussions with operators," Trainor said. "We hope the inspectors will spend time with individuals to help improve housekeeping and work practices."

Because most CAV-inspected mines have yet to receive a subsequent regular inspection, and MSHA is not certain all eligible operations are aware of the program, an accurate evaluation of its strengths or weaknesses cannot yet be completed.

"Some operators will probably say they didn't know about the program and want an inspection after they're in operation. Unfortunately, there are certain rules and regulations we must follow, and we won't be able to do that," Trainor said. In other districts, managers wonder how they will handle the additional workload of inspections.

There's been quite an acceleration in interest lately," Trainor added. "Areas of the industry that did not subscribe to the idea at first are calling in with requests." And, so far, most operator feedback has been positive.

"I think the CAV program is a step toward a more common sense-type inspection because it tends to make the inspector a partner rather than an adversary in providing a better, safer workplace," said Francis Janaszek, Pennsylvania sand and gravel operator who testified at the hearings.

Trainor views the program as an important step in building the mutual respect and trust essential to the success of MSHA's efforts.

"If someone gets hurt because of a safety violation, we've got to live with that," West Virginia quarry operator Ed Durr said. "If this program can save even one person from getting hurt or killed, its value cannot be overstated."

MSHA inspector Quinton Patterson checks a dust sampling device on a Pennsylvania underground coal miner. Under a recently proposed rule, miners or their representatives would be permitted to observe sampling procedures and would be compensated for the time spent doing so.

New Dust Rules Issued; Increased Participation Of Miners Proposed

By John F. McGrath
MSHA Staff Writer

MSHA has issued a final rule that improves and simplifies the required procedures for sampling respirable coal mine dust. The amendments also contain new requirements for the certification of individuals who must take samples and maintain and calibrate the equipment.

Published in the *Federal Register* in April, the changes reflect recommendations made by the National Institute for Occupational Safety and Health (NIOSH) and comments from miners, mine operators, and others received in public hearings in 1978. These changes to Part 70, Title 30, *Code of Federal Regulations,* take effect Nov. 1, 1980.

Two kinds of sampling will be required at bimonthly intervals. "Designated occupation samples" are to be taken for each unit of mining equipment used by a production crew for the extraction of material. Each of these units must be sampled for five consecutive shifts, on a bimonthly basis, with the sample collected in the environment of the occupation receiving the greatest exposure to respirable coal dust.

"Designated area samples" are to be taken outby the working face in areas where high concentrations of respirable dust occur, such as at transfer points and along haulageways. In these areas, samples must be taken once every bimonthly period. When the results show the respirable dust levels to be in excess of the standard's limit, five more samples, taken on consecutive shifts, will be required. If the average of these five samples is above the limit, MSHA will issue a citation to the mine operator.

To assist in compliance with the new procedures for sampling and to ensure that the sampling equipment is properly calibrated and maintained, the new rule will require that persons who perform these tasks be certified by MSHA.

Mine operators must submit the required samples to MSHA within 24 hours of sampling. The agency will then provide the operator with a computerized data report which must be posted on the mine bulletin board for at least 31 days. The posting requirement ensures that miners will have ready access to information concerning the respirable dust conditions in the mine.

Other notices of rulemaking appeared in the same issue of the *Federal Register,* complementing the amendments to Part 70 described above.

Changes in Part 75, the standards covering ventilation systems and methane dust control plans, become effective Nov. 1, 1980. Thereafter, all methane and dust control plans must list the specific locations where the newly required "designated area samples" will be collected.

Miner Participation

MSHA also is proposing an amendment to the new final rules for respirable dust sampling in underground coal mines to reflect suggestions made in the 1978 public hearings, where miners and their representatives expressed a lack of confidence in the reliability of the sampling program. Recognizing the need for the miners' faith in and support of the program, MSHA is proposing a way to significantly increase miners' participation in all aspects of sampling activities. Under the proposal, miners or their representatives would be permitted to observe the maintenance, calibration, distribution, collection, placement, and onshift examination of the sampling devices; removal of samples from the devices; and their transmittal for analysis to MSHA. The proposed rule also provides for compensation of participating miners.

Surface Mine Sampling

Another proposal would amend standards in Part 71 covering the sampling of respirable dust in surface coal mines, making these regulations conform to the new revisions in Part 70. The proposed requirements for sampling procedures, certified persons, maintenance and calibration, sampling devices and miner participation are similar to those in the standards for underground coal mines.

The most significant difference would involve the proposal's requirement for the sampling of "designated work positions"—the jobs associated with the greatest concentrations of dust. The district manager would require sampling at each work position at the mine where one or more samples (taken by the operator or MSHA) have shown the average concentration of respirable dust to exceed the standard's limits.

The proposed sampling cycle is identical to that required for the "designated areas" in Part 70: One bimonthly sample for each designated work position, with five more samples (on consecutive shifts) required if the first shows respirable dust concentrations that exceed the standard's limit. Compliance would then be determined on the basis of the average weight of the five samples.

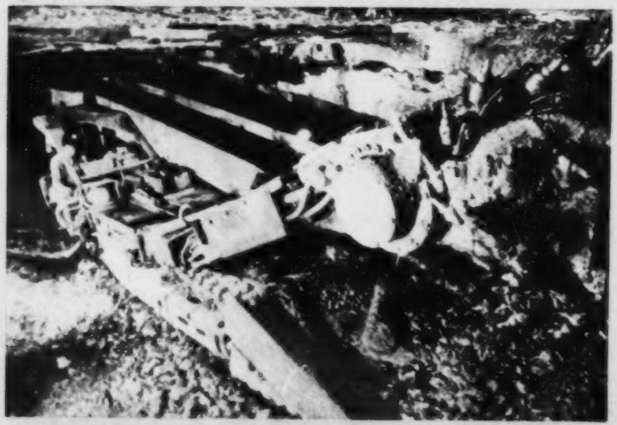
Transfer Rights

Finally, MSHA is proposing changes in the Part 90 standards covering miners who show evidence of the development of pneumoconiosis. These men and women, called "Part 90 miners", would have the option of working in an area of the mine where respirable dust levels are kept at or below 1.0 milligram per cubic meter of air (in contrast to the present standard, which calls for the "lowest attainable" levels below 2.0 mg/m^3). Under the proposed changes, Part 90 miners could not be assigned to any job, even on a temporary basis, where respirable dust levels exceed 1.0 mg/m^3. Mine operators would be required either to maintain the dust levels in the Part 90 miner's work area at or below this limit or to offer the miner a transfer to a position in a low dust part of the mine.

The amendments would protect miners who choose to transfer against any reprisals in the form of pay reduction, poor work assignment, or unreasonable working hours or conditions. Part 90 miners would have the right to transfer to an existing job on the same shift, with no loss of pay, and would be entitled to any pay increases relating to the new job.

In addition, the proposal would mandate a program of bimonthly sampling of each Part 90 miner to ensure compliance with the standard's limits. If the sample shows respirable dust levels above the 1.0 mg/m^3 limit, five more samples on consecutive shifts would be required.

Public hearings on the proposals will begin at 9 a.m. local time, with the dates and locations as follows:



New coal dust sampling rules address the problems of protecting miners' health both while doing jobs in face areas receiving the greatest exposures to respirable coal dust, such as that of continuous miner operator, and at locations other than the working face having high dust concentrations, such as haulageways and transfer points.

June 3, 1980—U.S. Bureau of Mines Auditorium, 4800 Forbes Ave., Pittsburgh, Pa.; and Holiday Inn North, Burley Room, I-75 and Newtown Pike, Lexington, Ky.

June 5, 1980—University of Charleston, Geary Student Union Ballroom, 2300 MacCorkle Ave., S.E., Charleston, W.Va.; and U.S. Post Office, Main Office Building, Room 269, 1863 Stout St., Denver, Colo.

The deadline for written comment is June 2, 1980. Requests to make oral presentations for the record should be submitted to: Mine Safety and Health Administration, Office of Standards, Regulations, and Variances, Room 631, 4015 Wilson Blvd., Arlington, Va. 22203 by May 30, 1980. The rulemaking record will remain open until June 20, 1980.

The entire rulemaking package is designed to make the required dust sampling process more efficient and more accurate, and to benefit both management and labor. Because few samples would be required, mine operators could reduce their costs. And miners would gain a more effective program of health protection, as well as the right to participate more fully in dust sampling activities.

Agreements Signed On Explosives Safety, New Coal Technology

MSHA recently signed separate agreements with two other Federal agencies in order to coordinate enforcement and research activities. Both agreements are aimed at improving safeguards for miners and reducing any duplication of effort in areas of common jurisdiction.

On April 9, officials of MSHA and the Treasury Department's Bureau of Alcohol, Tobacco, and Firearms (ATF) signed a memorandum of understanding regarding the safe and secure storage of explosive materials on mine properties. Under the agreement, the two agencies will cooperate in the development of uniform standards for storage of explosive materials and procedures for the inspection of mines where explosives are stored. To eliminate duplicate inspections, MSHA will inspect explosives storage facilities at mining operations for compliance with ATF regulations.

The agreement also specifies that:

- ATF will provide training to MSHA on its storage and recordkeeping requirements;
- MSHA will supply to ATF a listing of all mines under its jurisdiction;
- ATF will provide copies of its rulings and variances to MSHA, and the two agencies will exchange reports on investigations of explosives accidents and will draft working agreements on inspection procedures.

In a separate memorandum of understanding, published in the *Federal Register* on March 28, 1980, MSHA and the Department of Energy (DOE) agreed to coordinate safety and health protection for coal miners as new production technology is developed. The agreement establishes a joint committee to monitor research programs in coal mine production technology and to resolve any safety and health problems which may result. The agencies' goal is to make safe and efficient methods of coal production available to the mining industry.

Under the agreement, the joint committee will meet annually or more often, as necessary, to consider major technological projects with potential impact on the safety and health of miners. Also participating in the meetings will be representatives of the Bureau of Mines and the National Institute for Occupational Safety and Health.

Underground Coal Mantrip Injuries Up in Past 2 Years

Injuries involving mantrips in underground coal mines increased significantly in 1978 and 1979 according to a recent evaluation by personnel at MSHA's Health and Safety Analysis Center (HSAC) in Denver, Colo.

Mantrip accidents were blamed for 356 injuries and one death during 1978 and 240 injuries and another fatality during the first six months of 1979. Of the total of 598 accidents studied, about 16 percent occurred when mantrips struck other trips, motors, mine cars and debris, and roughly 12 percent were attributed to a failure to control trolley poles.

Poor track alignment, uneven haulageways and excessive speed contributed to derailments which accounted for about nine percent of the injuries, and 18 percent occurred when miners and trip operators struck the roof during mantrip travel. Overall, HSAC analysts said, a lack of overhead protection, failure of mine management to enforce speed limits, poor equipment maintenance and a failure to operate mantrips without the prescribed 300 foot separation were major contributing factors.

In other areas, HSAC recently analyzed injuries involving the use of handtools in both surface and underground coal mines during 1977 and 1978. Selecting every fifth injury of the 4,628 that occurred during that period, the researchers determined that more than 68 percent of the accidents resulted from careless use. Failure to wear eye protection and proper clothing and use of tools either worn or not suited to a particular job accounted for most of the other injuries.

Britain Acquires Large-Diameter Rescue Drill Rig

A drill rig capable of sinking large-diameter boreholes for the rescue of trapped miners in underground coal mines was recently purchased by Great Britain's National Coal Board (NCB). The $1 million West German-made Wirth L4 drill can reportedly sink a 21-inch diameter hole 1,640 feet on the first pass, later redrilling the hole to a 42-inch diameter to allow a suitable escapeway. The Wirth drill is expected to be able to reach about half of all current NCB operated mines.

'Maybe I should have listened to the safety committeeman!'

For deeper operations, the NCB has eight drill rigs which could be transported underground for emergency borehole placement to save time in gaining access to survivors. The rigs are capable of drilling large-diameter holes at any upward or downward angle.

When application of the Wirth L4 would be considered feasible, a faster exploratory rig would first drill five-to-seven inch holes for locating and making fast contact with the trapped miners, the bores later serving as passageways for food, water and communications. Powered by a 200-horsepower West German Deutz diesel engine, the Wirth would then be aimed at the refuge and the drill cuttings flushed from the hole by means of compressed air. Once completed, the borehole would accommodate a rescue capsule in which miners could be hoisted to the surface.

Though the NCB's drilling equipment has not been used in recent years for rescue work, the Wirth L4's predecessor, another large-diameter drill of the same make, has been used to drill several ventilation and drainage holes. To date, the new rig has had brief service punching a 158-foot borehole for a public utility company.

Upcoming Meetings, Events and Seminars

May

27-30	Institution of Mining and Metallurgy, the Society of Mining Engineers of AIME and the Metallurgical Society of AIME, first joint meeting on National and International Management of Mineral Resources, Hilton Hotel, London, England. Contact the Secretary, Institution of Mining and Metallurgy, 44 Portland Place, London W1N 4BR, England

Update

27-30	University of Missouri-Rolla, 21st U.S. National Symposium on Rock Mechanics, Rolla, Mo. Contact David Summers, Rock Mechanics Facility, Rolla, Mo. 65401
June	
4-11	Mine Safety and Health Administration, short course, Radiation Hazards in Mining, National Mine Health and Safety Academy, Beckley, W.Va. Contact Fran Rhodes, The Academy, Box 1166, Beckley, W.Va. 25801
9-20	Mine Safety and Health Administration, short course, Emergency Medical Technician, National Mine Safety and Health Academy, Beckley, W.Va. Contact Fran Rhodes, The Academy, Box 1166, Beckley, W.Va. 25801
16-18	The Pennsylvania State University, short course, Elements of Underground Coal Mining, (Fee $175), Keller Building, University Park, Pa. Contact PSU, 410 J. Orvis Keller, Conference Center, University Park, Pa. 16802
16-27	Mine Safety and Health Administration, short course, System Safety Engineering, National Mine Health and Safety Academy, Beckley, W.Va. Contact Fran Rhodes, The Academy, Box 1166, Beckley, W.Va. 25801
23-27	Mine Safety and Health Administration, short course, Coal Mine Ventilation, National Mine Health and Safety Academy, Beckley W.Va. Contact Fran Rhodes The Academy, Box 1166, Beckley, W.Va. 25801
29-July 3	National Coal Assn., 63rd annual convention, Hyatt Regency-Washington, Washington, D.C.

Recent Additions to the MSHA Library

- **IR 1112—Injury Experience in Coal Mining, 1978,** by staff, Division of Mining Information Systems, 355 pp., 55 Tables, 3 Figs.
- **IR 1113—Injury Experience in Stone Mining, 1978,** by Staff, Division of Mining Information Systems, 373 pp., 21 Tables, 3 Figs.
- **IR 1114—Injury Experience in Nonmetallic Mineral Mining (Except Stone and Coal), 1978,** by Staff, Division of Mining Information Systems, 299 pp., 21 Tables, 3 Figs.
- **IR 1115—Injury Experience in Sand and Gravel Mining, 1978,** by Staff, Division of Mining Information Systems, 89 pp., 17 Tables, 3 Figs.
- **IR 1116—Injury Experience in Metallic Mineral Mining, 1978,** by Staff, Division of Mining Information Systems, 240 pp., 21 Tables, 3 Figs.

These five informational reports review in detail the occupational injury and illness experience of the mining industries in the United States during 1978. Data on work injuries, reported by mine operators under the requirements of 30 CFR Part 50, are summarized by work location, accident classification, part of body injured, nature of injury, occupation and mineral industry. Correlative information on worktime, employment, operating activity and—in the case of coal—production is also presented.

These publications report injury rates and severity measures on a different basis from annual injury experience reports of previous years. The new measures are consistent with those used for other industries by the Bureau of Labor Statistics. For the first time, a table of reported occupational illness cases is included in each publication.

Films

1. Underground Blasting: Safe Blasting Procedures in Metal and Non Metal Underground Mines (Film No. 872)

Here's How to Obtain Reports And Films

Single copies of Informational Reports are available through:

MSHA, Office of Information
4015 Wilson Blvd., Rm. 1237-A
Ballston Tower No. 3
Arlington, Va. 22203

Films can be borrowed from the National Distribution Center in Pittsburgh, Pa. Send all requests to:

Motion Pictures
MSHA
4800 Forbes Ave.
Pittsburgh, Pa. 15213

Films can be purchased by directing requests to:

Chief Division of Audio Visual Services
MSHA, Education and Training
4800 Forbes Ave.
Pittsburgh, Pa. 15213

Safety Technolgy

Stamp of Approval

The following equipment has been recently added to the Mine Safety and Health Administration's list of permissible or approved equipment:

- **Model DP-112, 12 volt, battery-powered, "The Champ" desk pager mine telephone,** issued to Jabco Inc., Edensburg, Pa.;
- **Model No. CD-700, 9-volt, battery-powered, cable fault detector,** issued to American Mine Research Inc., Bluefield, W.Va.;
- **Model U22-4A, diesel-powered utility vehicle,** issued to Elmac Corp., Carlsbad, N.M.;
- **Model MMD, diesel-powered locomotive,** issued to Plymouth Locomotive Works, Inc., Plymouth, Ohio;
- **Model ST-5B, diesel-powered Wagner Scooptram,** issued to Wagner Mining Equipment Co., Portland, Ore.;
- **Model ST-5E, diesel-powered Wagner scooptram,** issued to Wagner Mining Equipment Co., Portland, Ore.;
- **Model HDO-D, diesel-powered J. H. Fletcher roof drill,** issued to J. H. Fletcher & Co., Huntington, W.Va.;
- **Model TD12-1-1-1E, dual arm, roof drill** with integral dust collecting system, issued to Lee-Norse Co., Pittsburgh, Pa.;
- **Model 10SC22 A/B shuttle car,** with (2) 20, 30 or 35 h.p., 250 V.D.C. traction motor, (1) 20, 30 or 35 h.p., 250 V.D.C. conveyor motor, and (1) 13 h.p. 250 V.D.C. pump motor, issued to Joy Manufacturing Co., Franklin, Pa.;
- **Longwall mining system,** 950/460 volt, 3 phase, 60 hertz, alternating current, with (3) 200 hp, (4) 75 h.p., and (10) 300 h.p. 950 volt, A.C. motors, issued to Dowty Corp., Zelienople, Pa.;
- **Model No. COMPUR 4100 monitox, 2.7 volt, battery-powered toxic gas detector,** issued to MDA Scientific Inc., Park Ridge, Ill.;
- **SCOF PN or SCOF coalseal or SCOF Flexseal conveyor belt,** issued to B.F. Goodrich Co., Akron, Ohio;
- **Mine King conveyor belt,** issued to Tokai Rubber Industries, Ltd., Chicago, Ill.;
- **CM-300 Fire Resistant conveyor belt,** issued to Globe Albany Belting, Buffalo, N.Y.;
- **MSHA IC-28/5 for cover compound 9689 for Empex SAE 100R4, B-164 hydraulic hose and MSHA IC-28/6 for cover compound 9687 for Empex R-135, air hose** issued to Empex Industrial Hose, Long Beach, Calif.;
- **MSHA IC-49/4 for strataseal stopping Mix X-9 and MSHA IC-49/5 for Strataseal stopping Mix X-2 for use as sealants** issued to Strataseal, McMurray, Pa.;
- **MSHA IC-66 Aero Seal Formula No. 1, Concrete-Gunite Mix, MSHA IC-66/1 Aero-Seal Formula No. 2, Concrete-Gunite Mix, MSHA-IC-66/2 Aero-Seal Fiberglass Reinforced Concrete-Gunite Mix, MSHA IC-66/3 Aero-Seal Steel Fiber Reinforced Concrete-Gunite Mix** for use as mine sealants issued to CISCO, Pounding Mill, Va.;
- **Model 180P and 180R methane detectors,** issued to CSE Corp., Monroeville, Pa.;
- **Model No. 537A, 12 volt, battery powered, mine telephone,** issued to Western Electric, Newark, N.J.;
- **Model 10SC22, 44/550 volt, 3 phase, 60 hertz, alternating current shuttle car** with (2) Reliance 40 hp traction motors, a Reliance 25 hp conveyor motor, and a Reliance 10 hp pump motor, issued to Joy Manufacturing Co., Franklin, Pa.;
- **Model 001 bloser and dust collecting machine,** 440 volt, 3 phase, 60 hertz, alternating current, with (1) General Electric 440 volt, 10 hp motor; (1) General Electric 460 volt, 30 hp motor; (1) Reliance 440 volt, 5 to 7½ hp motor; and (1) Joy 440 volt controlfer, issued to Bamco of W.Va. and B & J Manufacturing Co., Morgantown, W.Va.
- **Longwall mining system,** 950 volt, 3 phase, 60 hertz, alternating current, with (1) 230 hp, (2) 200 hp, (2) 75 hp, and (2) 40 hp, 950 volt, AZ motors, issued to Eickhoff-National Mine Co., Pittsburgh, Pa.;
- **Longwall mining system,** 950 volt, 3 phase, 60 hertz, alternating current, with (1) 300 kw, (2) 75 hp, (2) 200 hp, and (1) 150 hp 950 volt AC motors, issued to National Mine Service Co., Ashland, Ky.;
- **Longwall mining system,** 950 volt, 3 phase, 60 hertz, alternating current, with (1) 275 hp, (1) 40 hp, (2) 150 hp, and (2) 75 hp, 950 volt motors, issued to Jeffrey Mining Machinery Division, Dresser Industries, Inc., Columbus, Ohio;
- **Model 21SC-A AC/DC shuttle car,** 440/550 volt, 3 phase, 60 hertz, alternating current with (1) 25 hp, 440 or 550 volt AC conveyor/pump motor, (2) 20 hp, 250 volt, DC traction motors, issued to Joy Manufacturing Co., Franklin, Pa.;
- Acceptance is issued to Goodyear Tire & Rubber Co., Government Sales Department, Akron, Ohio for the following:
- **Goodyear Glide Coal Belting,** Specification Nos. 21372-362, 363, and 365.
- **Goodyear Glide Coal Belting,** Specification Nos. 21372-366 and 367.
- **Goodyear Grain Belting,** Specifications Nos. 21372-348 and 349.
- **Goodyear Grain Belting,** Specifications Nos. 21372-344 and 21372-347;
- **Lo Temp Coal PN Conveyor Belt,** issued to B.F. Goodrich Co., Engineered Products Group, Akron, Ohio;
- **Urelock FR Conveyor belting,** Urelad-FR500, issued to Unilok, Georgia Duck & Cordage Mill, Scottdale, Ga.;
- **Safe-FRT 3100, Mine Conveyor Belt,** issued to Sumitomo Corp. of America, c/o Tokai Rubber Industries, Inc., Chicago, Ill.;
- **Neoprene Sierra Mine Service Conveyor Belt**—334315, issued to Victor Balata Belting Co., Newcastle, Calif.;
- **Megtek Chemical Battery Casting Compound X-811,** issued to C&D Battery Division, Plymouth Meeting, Pa.;
- **Vitralon Epoxy Powder Coating,** for use on battery trays (cases), issued to Pratt and Lambert, Buffalo, N.Y.;
- **Hose Conduit,** I.D. 39010, issued to Cambria Rubber Co., Inc., Lawrence Industrial Park, Trenton, N.J.;
- **"ABC Vinolon FR Medium "B" plastic brattice cloth,** issued to Peabody ABC Corp., Warsaw, Ind.;
- **Compound No. 04-5953, for use as cover on hydraulic hose,** issued to Uniroyal Inc., Oxford Management and Research Center, Middlebury, Conn.;
- **Black Hydraulic Hose Compound 51011,** issued to Swan Hose Division, American Corp., Bucyrus, Ohio;

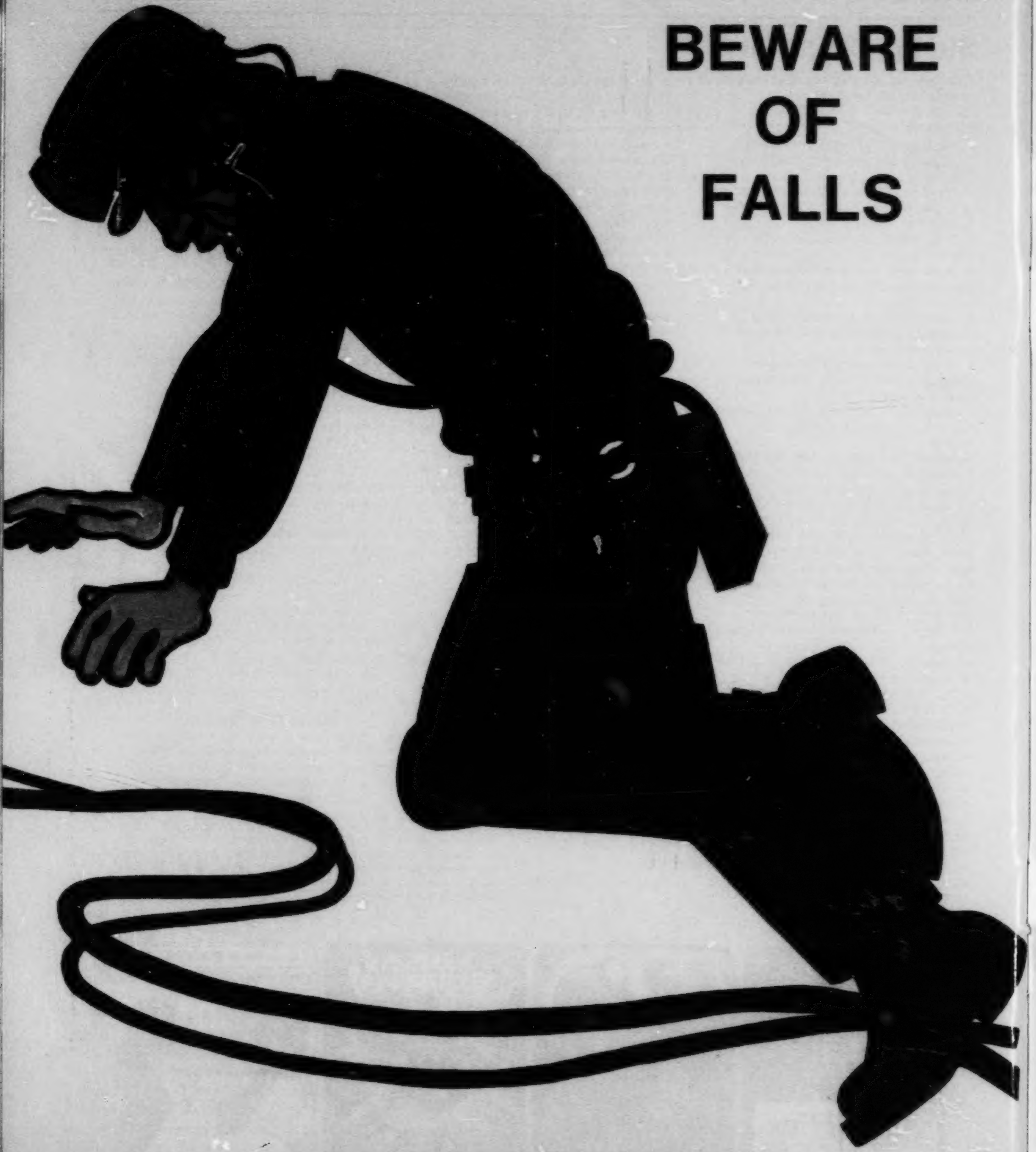
The poster on the following page is designed to encourage miners to observe and work toward improved safety practices. The poster, which was created by Art Director Columbus P. Knox, can be cut out of this issue and placed on bulletin boards or at other locations regularly passed by working miners.

Lumps 'N' Chunks

Drawn by C. P. Knox

WE NEED TWO SECTIONS OF COMPRESSED AIR LINE OVER IN 117. DON'T FORGET TO BLEED OFF THE AIR.
Hmmm... DARN PIPEMAN MUST BE SICK. SURE HATE THESE CRUMMY JOBS!
KaBOOM
Mi Cariño, WHAT HAPPENED?
WELL MARIA, I WAS THINKING OF YOU WHEN I SHOULD HAVE BEEN.

BEWARE OF FALLS



The DeLamar Silver Mine in southwestern Idaho was one of a number of metal and nonmetal mines in all parts of the Nation which significantly improved their safety records with the help of MSHA's special accident reduction program. Above, Bob Parrish, company safety director at the time of the program, gives safety training to employees.

PAR

(Continued from Page 8)

"This company has been bringing down accident rates and turning around its whole safety program," said Francis Csepregi, who conducted the program. "They've realigned management, brought in safety professionals and developed new policies. And we've had full cooperation of union people.

"I'm more proud of what they've done at the Lea Mine than I am of some other programs we've had where you could see the results a lot sooner. They're still on the PAR list this year, but there's a good chance they'll be off the program when the new list comes out."

Hugh Graham, the South Central District PAR coordinator, said, "Francis Csepregi deserves a lot of credit. It was discouraging at times, but he was persistent."

In addition to the prescribed steps followed by PAR specialists—including a pre-investigation conference with company officials and miners' representatives, interviews and hazards analysis, an evaluation report, a "closeout" conference with management, and followup visits—investigators have some flexibility to use slightly different approaches and types of MSHA-approved educational materials, depending on circumstances at the mines involved.

Most PAR activities are conducted by one investigator, but teams of two inspectors also have been used. Investigators deal with mine employees both in groups, as in meetings with joint safety committees, and on a one-to-one basis. The use of special safety training sessions and audiovisual training aids also differs from mine to mine.

MSHA's Southeastern District has produced a series of safety booklets featuring a cartoon character, "Stoney Hardrock", which have been useful in local accident reduction efforts, according to PAR coordinator Ron Hallmark. The booklets have been translated into Spanish for use by Spanish-speaking miners. For mines which have not been scheduled to have the full PAR effort but ask for special help in solving safety problems, the district offers a "mini-PAR" service consisting of visits, safety advice and other aid.

At PAR mines in the Northeastern District, a videotape recorder is used to film supervisors and miners on the job, enabling them to study safety aspects of their work practices.

Despite the demonstrable impact of the Program in Accident Reduction, it has been administered unevenly throughout the country over the years.

This year, a high priority has been given to further improving the program.

Frank DeLimba, MSHA Metal and Nonmetal Mine Safety and Health safety chief, is directing preparation of national PAR guidelines aimed at achieving more uniformity in PAR activities and improving the training of PAR personnel. And a course tailored specifically to the needs of PAR field people is being developed and will be given for the first time later this year at the National Mine Health and Safety Academy.

> *"The role that I attempted in this program was to try to motivate company personnel and find the problems. The direction and emphasis I would have taken . . . would perhaps have been different, but I never would have generated the pride that the people of this company now have because they developed their own program and made it work."*

At a recent conference of PAR coordinators, DeLimba called for renewed support of the program at the MSHA district, subdistrict and field office levels. "So far," he said, "the record has been good. But we're going to do everything we can to make it better."

Inspector Clyde McMillian, a grassroots PAR enthusiast, can come up with at least a dozen reasons why the program works. One of the most important, he suspects, has something to do with changed attitudes of mine managers, supervisors, miners, and—yes—even MSHA inspectors.

"It has to be a cooperative program, of course," he said, "and that means there's no room for the old adversary attitudes. And in PAR, you focus on solutions rather than problems. When you get involved in the program, you become very solution-minded."

Loading and hauling accidents historically have been among the leading causes of deaths and serious injuries in metal and nonmetal mining. Program in Accident Reduction (PAR) investigators closely study work practices, equipment maintenance and other aspects of this and other operations to assist companies in eliminating unsafe practices and conditions.

Process

(Continued from Page 8)

injuries are then summed, and the result is divided by the mine's exposure time to form a measure of the mine's level of hazard.

As with any rate based on a ratio of injuries to exposure time, small mines may occasionally show inordinately high values of the index, on the basis of only one or two injuries. The index, therefore is adjusted by a factor determined mathematically to stabilize the injury rates at smaller mines. The resulting index is higher at a small mine than at a large mine only when the rate of injuries at the small mine is far worse than at the large mine.

Assume for example, that an underground metal mine worked 50,000 employee-hours during a year, and that it experienced five lost-workday injuries. Suppose two of the injuries were of type A, two of type B, and one of type C; and the national average severities of injury types A, B, and C at underground metal mines are 150, 300, and 75 days lost, respectively. The EII for the mine would be formed by first calculating:

$$[(2 \times .150) + (2 \times .300) + (1 \times .075)] \times \frac{1,000,000}{50,000}$$

This works out to be 19.5. To adjust this figure for a mine of this size, the following quantity is calculated and then subtracted from the 19.5:

$$1.96 \times \frac{1,000,000}{50,000} \times \sqrt{2 \times (.150)^2 + 2 \times (.300)^2 + 1 \times (.075)^2} = 18.8$$

$$19.5 - 18.8 = 0.7$$

Finally, the square root of 0.7 is taken, yielding an Extended Injury Index of 0.8. The mines are assigned a ranking on the basis of their index, with that mine having the largest EII getting an Extended Injury Index rank of 1. It should be noted that, while the average severity used in the calculation relates to mines of the same general type, the results for mines of different types are directly comparable and may all be included in an overall ranking.

In selecting mines for special attention, it is not only the level of hazard (as reflected in the EII ranking) that is important, but also the absolute number of injuries that a special program may be expected to help eliminate. Regardless of exposure time, effort at a mine consistently experiencing a great many injuries might be expected to have more impact—in terms of the number of workers spared injury or death—than a similar effort at a mine experiencing relatively few injuries. At the same time, it would seem more desirable to concentrate special attention on mines whose record was already showing a consistent trend of improvement. These two points are combined in a second rank ordering of mines according to their projected "Serious Injury Surplus" (SIS). Serious injuries are defined as all lost-workday injuries.

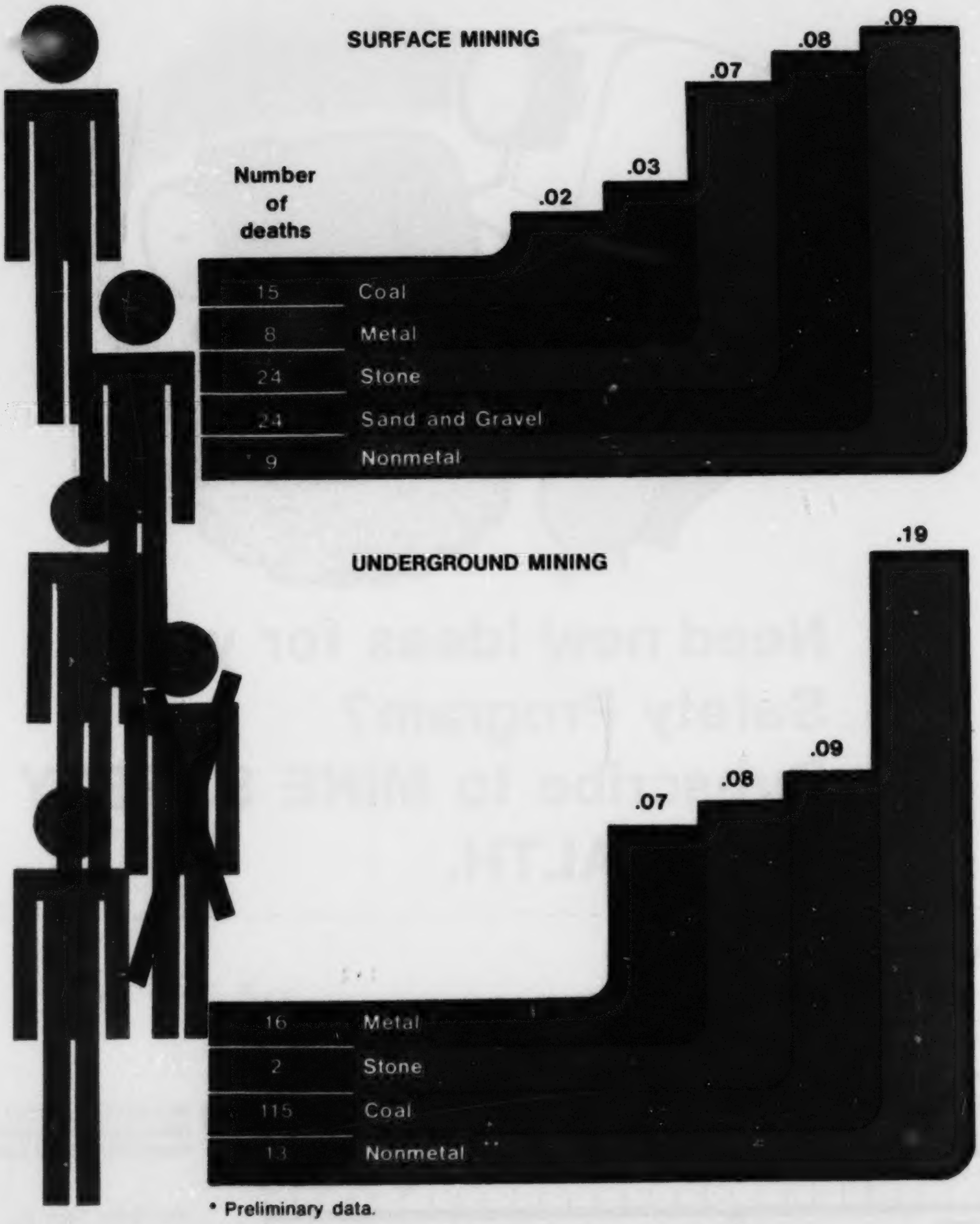
The surplus of a mine for a given time period is calculated by first multiplying the national lost-workday injury rate for that type mine by the number of million man-hours worked at the mine. This yields the number of lost-workday injuries that would be expected at the mine if it were experiencing injuries at the national rate. This number is then subtracted from the number of lost-workday injuries actually experienced at the mine to yield the "surplus" (either positive or negative) for the period in question.

The surplus for successive quarters, going back three years, is tested for a statistically significant upward or downward trend. If a significant trend exists, it is extrapolated to project the total SIS for the coming year. If no significant trend exists, then it is simply assumed that the surplus for the coming year will be four times the average quarterly surplus. In either case, a projected Serious Injury Surplus is calculated for each mine, and as in the case of the EII, the SIS's for mines of different types are directly comparable. The mine with the highest projected SIS receives the rank of 1 on the overall Serious Injury Surplus ranking.

Each mine, therefore, receives an SIS rank as well as an EII rank. In order to take all five factors listed above into account, the two rankings are than merged into a final ranking. This is done by adding the two ranks together and then re-ranking the mines according to the sum. A mine, for example, with an Extended Injury Index rank of 10 and a Serious Injury Surplus rank of 4 receives a higher final ranking than a mine with an EII rank of 1 and an SIS rank of 14.

Fatality rates in surface and underground mining industries in the United States during 1979*

Fatality rate per 200,000 employee-hours



* Preliminary data.

** Explosion at Belle Isle salt mine accounted for five fatalities.

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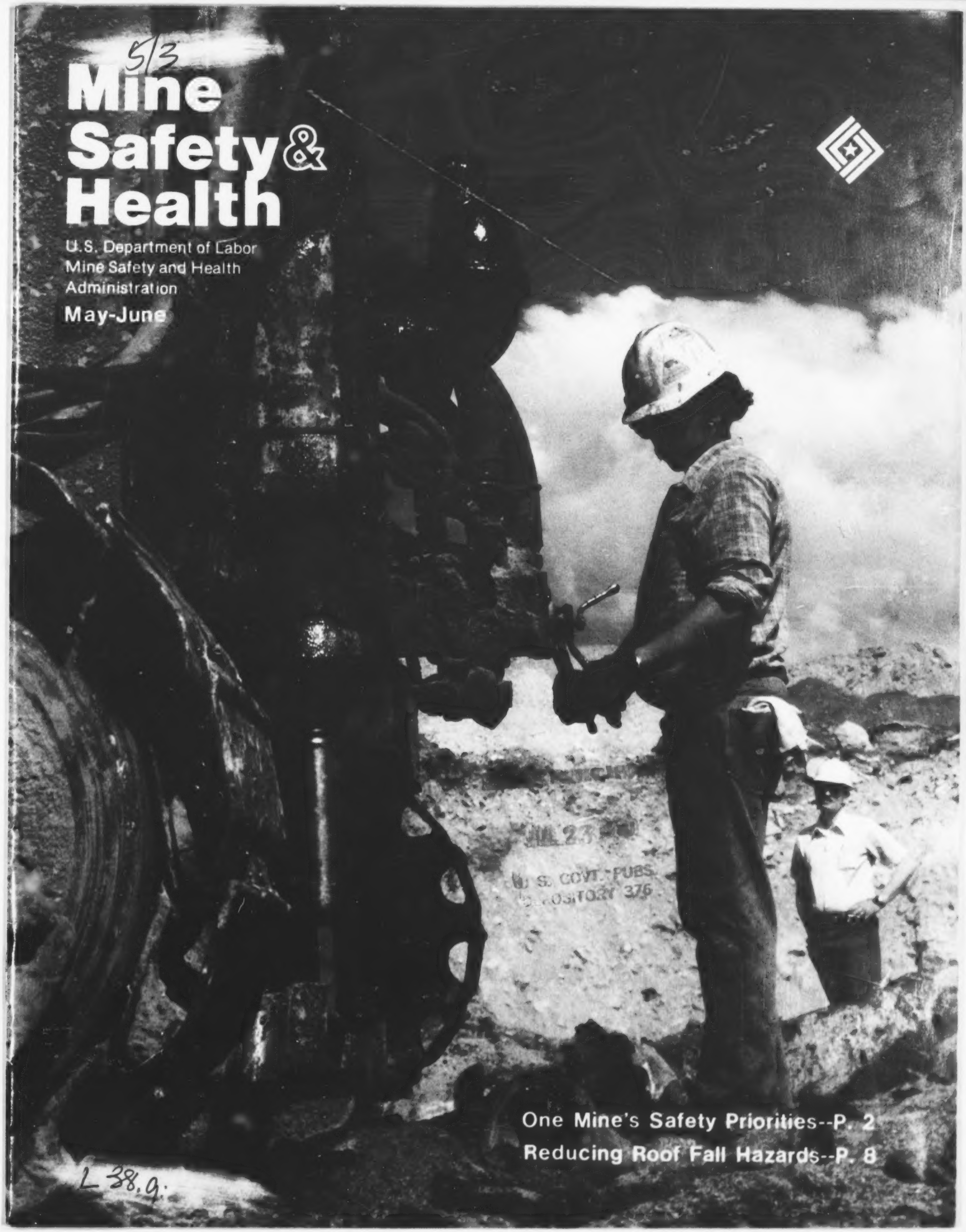

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One Mine's Safety Priorities--P. 2

Reducing Roof Fall Hazards--P. 8

L 38.9:

What They're Saying . . .

"I'd like to see new training programs run on the state level which were modeled after the MSHA and Joint Industry Training safety training programs . . . Educating the miners (on safety issues) is probably the primary answer to safety problems faced at most mines."

—Bart Lay, former longtime United Mine Workers of America safety specialist following his appointment as assistant director of the West Virginia Department of Mines.

"The bond between miners is stronger than (the bond between) most working people. It has to be. You let something happen in the coal mines and everybody would die together. So coal miners stick together. You can stand there and cuss a man—call him everything in the world. But if you get hurt, he's right there by your side to help you. They'll risk their lives to get you out of there . . .

"But now going down the road, if you see an automobile wreck, how many people would pass that wreck? Half of them won't stop 'cause they're afraid they'll get involved. And in a factory, nobody knows nobody . . . Miners do stick together, regardless of race, creed or whatever. I guess you could say it's a big family."

—a longtime miner from Letcher County, Ky., who had narrowly missed death in a roof fall, quoted in The American Coal Miner, a report of the President's Commission on Coal.

"I've found that, if a man complains about his equipment, something is done about it. If a woman complains, they take the attitude that, if you can't operate your machine, you ought to go sweep in the shop where you belong."

—Laurie Castleberry, a co-founder of Women Miners of Wyoming, in an Associated Press article.

"We precondition (mine employees) to 'buying' safety—just as you would breakfast cereal or soda pop—in a variety of unique ways, and then keep up the hard-sell right to the 'point-of-purchase.' (at the miner's working place)."

—Hazlett A. Cochran, vice president, corporate public relations, Consolidation Coal Co., from a presentation at the International Coal Show.

"A safe mine is a productive mine, and I can prove that with statistics that show that if you keep the incidence rate down, production goes up."

—Robert Harmon, assistant director, West Virginia division, Westmoreland Coal Co., quoted in the Washington Evening Star.

Mine Safety & Health

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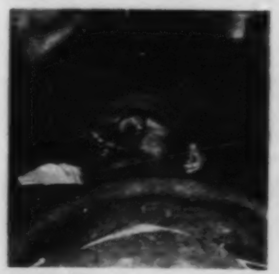

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A drilling operation is shown at the Sherwood uranium mine in Washington state, which was named for a late Spokane Indian tribal leader. The photo is by Ralph Lewis.
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Ray Marshall, Secretary
United States Department of Labor

Robert B. Lagather, Assistant Secretary
Mine Safety and Health

Wayne E. Veneman, Chief
MSHA, Office of Information

Samuel A. Stafford, Editor, Mine Safety and Health Magazine; Ralph E. Lewis, Assistant Editor; Columbus P. Knox, Art Director; Fred Bigio, Graphics Consultant; Sharon Maines, Editorial Clerk. Photos with article on the Sherwood Mine's safety and health program by Ralph Lewis; Photos with article on roof fall hazards provided by MSHA Coal Mine Safety and Health, MSHA Audio Visual Office, and by Robert Stahl, MSHA Technical Support Center, Denver; photos with article on rescue of miner under a protective canopy provided by the Johnstown, Pa., Tribune-Democrat, the Indiana, Pa., Indiana Evening Gazette, and MSHA mine inspector Samuel J. Weible; Photos with article on women miners by Debra Howerton; Photos with article on mining educators' seminar by Katherine Snyder; Photo on Sunshine Mine disaster commemoration by Ralph Lewis.

Employees of the Sherwood Mine near Spokane, Wash., worked more than 512,000 hours last year without a lost-time accident. Production at the acid-leach uranium mill shown above was almost brought to a standstill when the complex was covered with volcanic ash following the first eruption of Mt. St. Helens just days after this picture was taken.

Training, Accountability Pay Off

Support of Top Management Is Key To Safety at Sherwood Mine, Mill

By Ralph Lewis
Assistant Editor, Mine Safety and Health

When Alex Sherwood died at the age of 72 in June 1974, several members of the Spokane Indian tribe gathered at the small, Wellpinit, Wash., cemetery to mourn a leader many thought would be the last of the great, old-time Indian chiefs. Though Sherwood lived a modest life along the banks of the Little Chamokane Creek, he had become a powerful spokesman for Indian rights over the years, "the dean of tribal council chairman," some said. Under his 26-year guidance as chairman of the Spokane tribal council, new industry came to the reservation, educational opportunities improved, and in a stunning 1967 victory, the tribe won a $6.7 million settlement for lands ceded to the Federal government 80 years before.

It was only appropriate then that Western Nuclear, Inc., a subsidiary of Phelps Dodge Corp., would name its surface uranium mine and milling operation after Sherwood when construction of the complex began on the 151,000-acre Spokane Indian reservation in 1977. Since then, the Sherwood Mine has earned a reputation among local MSHA officials as an operation that has put to good use many principles of modern mine safety management—ideas that have paid off both in a remarkable safety record, and in a growing pride among the nearly 330 employees there. From September 1978 through August 1979, employees worked more than 512,000 hours without a lost-time accident, and the operation's incidence rate for all injuries (per 200,000 hours worked) for 1979 was 1.33, considerably below the rate of 7.37 for all surface metal mines that year.

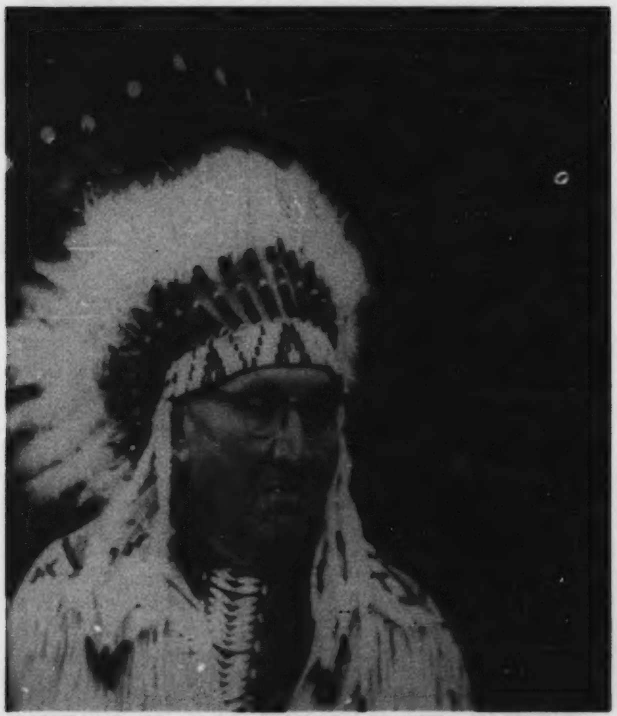
"It's one of the most impressive outfits I've ever seen," said MSHA inspector Alvin E. Fischer, who is based in Couer d'Alene, Idaho. "For one thing, its safety department is not held to a budget, it's a well structured organization, and they have one of the best training plans going."

> *"Even the minor accidents, ones that hardly ever get serious attention, can develop into fatal situations if the causes are left unchecked. That's why we have to be so strict on safety around here . . ."*

Fifty miles northwest of Spokane, Wash., on a 1,200 acre tract leased from the tribe, the Sherwood Mine has been excavated high above the shores of Lake Roosevelt, a dammed portion of the Spokane River. Though the soil is sandy and dry, the river irrigates several thousand acres of winter wheat and alfalfa, the latter good fodder for the many ponies locals breed and race. Over the years, too, loggers have carefully culled selected timber from great stands of long leaf "bull" pine, and in late Spring, small clumps of yellow sunflowers the Spokanes call "Smokashin" and tiny "bluebells" sweep generously across rocky meadows to invade shady forest floors.

For the most part, the Sherwood complex is an inobtrusive patch on the landscape, the buildings colored a light yellow and tan in an effort to blend the facility into the sandy color of the immediate environment. Each month, roughly 800,000 tons of overburden and low grade uranium ore is blasted from a tough seat of granite and basalt, and daily, at capacity, the mill can process about 2,000 tons of ore, yielding about a pound of "yellowcake" per ton. Though about 65 per cent of the workforce is of Indian descent, many employees live off the reservation, some as far as 50 miles away. For that reason, management recently switched the work schedule to two 10-hour shifts, four days a week in an effort to cut down on employee gasoline expenses.

MSHA inspector Alvin E. Fischer checks activities inside Sherwood's mill complex, which, operating at full capacity, can process about 2,000 tons of uranium ore daily.



The late Alex Sherwood, a Spokane Indian leader for whom the mine was named. About 65 per cent of the Sherwood Mine's workforce is of Indian descent.

Much of Sherwood's safety program is based on the experience of George Meenach, 46, the mine's safety director. A Phelps Dodge employee since 1954 when he started as a laborer, Meenach joined the safety department in 1970 at the company's surface and underground copper mining operations in Arizona.

The safety program in Arizona provided the basic model for his organization, Meenach said, but his personal philosophy has apparently accounted for some innovations of his own—many the result of his years as a private and commercial pilot and flying instructor.

"I love flying, but I'm scared to death of it," he said. "Many of my old flying buddies . . . in fact, most of my instructors, are dead now. In flying, it only takes a very simple mistake to get yourself killed, and that's what happened to most of them.

A shovel unloads low-grade uranium ore into a haulage truck at Western Nuclear, Inc.'s Sherwood Mine. Although harsh winters make equipment maintenance conditions difficult, no mechanic suffered a lost-time injury during the winter of 1979 when temperatures dipped to 30 degrees below zero.

"In mining, it's the same thing. Even the very minor accidents, the ones that hardly ever get serious attention, can develop into fatal situations if the causes are left unchecked. That's why we have to be strict on safety around here. I'm sure there are a few people who don't like it, but it's all for their own good."

Meenach can be tough. He has the authority to "pink-slip" everybody from hourly employees on up to production supervisors, a stick he wielded a few times early in the game, but uses sparingly now that the company's safety record has improved. For the most part, the safety department at Sherwood is independent of the production side, and Meenach seems convinced that his setup is the only way to fly.

> *"I answer only to the resident manager, and when it comes to safety, the production people have to answer to me . . . When it comes right down to it, people have to be held accountable for their actions . . ."*

"I answer only to the resident manager, and when it comes to safety, the production people have to answer to me. Of course, there are many components to a good safety program, but when it comes right down to it, people have to be held accountable for their actions," he said.

Even so, the company's safety program is not so much rooted in a "crime and punishment" approach as it might first appear. Instead, "safety awareness" cultivated among employees through education and training, safety meetings and an incentives program has been the main reason why the mine has had such a remarkable safety record, Meenach believes. "Most of the people here had very little experience in mining or with any kind of safety program when we came up here," he said. "At first, some people were uncomfortable with our rules and regulations, but as time went on, they learned through experience that mining is not just an ordinary job."

Meenach also credits much of the success to Sherwood's supervisory staff. "For the most part," he said, "our supervisors and foreman are real sincere in their safety efforts. After all, a safety program can only be as good as the people you have on the front-line."

A small FM radio telephone on Meenach's desk is a small part of the communications system that Meenach has designed to keep all employees alert to any hazard as it might occur. The system begins with Meenach's staff of six specialists—a mine safety supervisor, a mill safety supervisor who is also a registered nurse, radiation safety officer, fire protection officer, and head security guard.

Equipped with hand-held radios, both mine and mill safety supervisors are responsible for inspecting their respective work areas daily. Should a serious hazard be discovered, a safety supervisor will first contact the responsible foreman through the radio network, then meet with that person to discuss the situation and make certain the violation is corrected. Less serious violations of the "housekeeping" variety, if found, are listed on a daily written report compiled at the end of shift.

These reports are reviewed thoroughly in monthly "branch" safety meetings during which all department heads meet with Meenach and the mine's resident

Debbie Baughman, Sherwood's radiation safety officer, samples for radiation at a conveyor belt transfer point in the mill area. Sampling is done at 36 locations in the mill complex.

manager. Should a violation be repeated frequently or remain unabated, or should a lost-time accident occur, the responsible department head must offer an explanation before the group. In many cases, Meenach will document the event with a Polaroid snapshot, useful ammunition when trying to prove a point, he said. "Basically we'll identify problem areas then discuss what preventative measure can be taken. Here again, we can get good feedback from each other, perhaps come up with some fresh ideas," Meenach said.

Recommendations made in the branch meeting are then passed along to all foremen during their regular monthly safety session. Again, all violations and accidents, if any, are reviewed, preventative actions discussed, and the minutes of the meeting included in a report forwarded to the safety department. Finally, monthly safety meetings for the hourly employees of each shift crew are held. Included in these are short courses in accident prevention that meets MSHA's requirement that all metal and nonmetal surface mine workers receive eight hours annual retraining. Any employee who misses a meeting is required to make it up at another time. Attendance seems high, though.

> *"They thought we were going a little overboard, and I suppose it took them a while to get used to the idea . . . Fortunately, we had the backing of management from the beginning . . ."*

At the end of each session, employees who have worked a designated number of hours without a lost-time accident are awarded with bonus money—part of a recently developed incentives program made retroactive for all employees. The hours an employee must work before receiving an award are based on the overall accident experience in each department. Mill and mine employees must each work 1,000 hours for instance, but maintenance workers only have to work 750 hours since their department has a higher risk experience. For the first safe work period, the award is $10, the next, $15, and after that, $20 for each consecutive period.

A group award plan designed to foster pride among shift crews requires that a crew or "unit" work a designated number of days—180 for the mine and mill crews, 130 days for maintenance—without a lost time-accident. Winning crew members receive dinner for two at one of six participating restaurants. So far, this concept has worked well, Meenach said. "Aside from the fact that it gives people a sense of accomplishment, it also makes them look out for each other. As an added bonus on the production side, I think it keeps people from faking accidents such as back sprains and the like. After all, I don't think I'd want to be the guy who cost his whole crew a free dinner just for a day off."

Ordinarily, an incentives program might result in the occasional "cover-up" of accidents, Meenach believes, but he has purposely withheld placing first-aid kits in any of the working areas—requiring instead that anyone with an injury, however minor, report directly to the company's well-equipped first-aid station. Since the station is no more than two-minutes travel by pickup truck from any location on the site, and because any accident must be reported to the safety department, this system in no way prevents immediate treatment of an injury, Meenach said.

Sulfuric acid is unloaded from a tank truck into a storage facility at the mill by an employee equipped with a protective face shield and acid-resistant rubber gloves and suit. Nearby, but not pictured, a similarly-equipped worker stands by with a radio in case of accidental spillage.

Any injury, whether it be a cut finger or scraped elbow, must be explained to the safety department in a one-page written report by the responsible foreman within 24 hours. A record of these events is filed in the department and copies are reviewed in the monthly safety meetings for both foremen and employees. A lost-time accident requires an investigation by an independent, three-person committee composed of a member of management, an hourly employee from another department, and a member of the safety department not involved in the initial investigation. "Sometimes you can't see the forest for the trees," Meenach said, "but this way, you can get a much more objective look at what happened and why."

Mike Tredway, Sherwood's mill safety supervisor and a registered nurse, checks contacts of a portable electrocardiograph (EKG) machine with a cardiac defibrillator for emergency use in heart attack cases. The machine has been instrumental in saving the lives of two employees.

At first, some supervisors objected to the stringent safety approach. "They thought we were going a little overboard, and I suppose it took them a while to get used to the whole idea," Meenach said. "Fortunately, we had the backing of management from the beginning. The day we opened the mine for production, we had a safety meeting as the first order of business. The general superintendent told everybody I had full authority to stop production if need be, and generally outlined my role here. I think the company's safety policy is pretty well spelled out."

It is, in fact, detailed in a lengthy, five-page statement new employees receive during their first training session. "Management firmly believes in doing everything possible to avoid accidents," the paper reads in part. "It is through application of all methods of education, and, if circumstances warrant, judicial discipline, that enforcement is achieved."

"We really don't have to be hard on people most of the time," Meenach said. "We concentrate most on developing safety consciousness among our employees through training, then continue to hammer safety in them through the safety meetings. The way we see it, it all begins in the classroom."

All employees at Sherwood, including experienced miners who have come from other mining operations, receive the 24-hour training required by MSHA for all new surface metal miners. All employees also take an 18-hour first-aid course, 10 hours of which qualifies them for MSHA certification. The eight-hour MSHA requirement for annual retraining is included in the monthly safety meeting, but the training doesn't stop there.

Washington state's Department of Social and Health Services, under an agreement with the Nuclear Regulatory Commission, requires that all employees of the operation undergo a short course in radiation safety. Mill employees also receive training in the use of respirators that are worn in some areas of the mill to minimize exposure to radionuclides. About 40 employees have been trained in the use of the self-contained breathing apparatus, eight of which are stocked at building entrances in sealed cabinets around the mine site.

Once a year, the safety department holds a "fire week" during which a Spokane firefighting equipment company demonstrates different types of extinguishers on controlled fires. Mine employees are given the chance to douse the fires with the type of extinguisher provided for the kind of fire that might occur in their respective workplaces. The company also has on hand two 6,000-gallon capacity water trucks that are normally used for road dust suppression, and shortly it will have converted a pickup truck to carry a 500-gallon tank with a "piggyback" 250 gallon capacity pump. All high-risk areas in the complex—the mill, warehouse and administration building—are equipped with sprinkler systems and fire

Alvin Fischer, left, and George Meenach check one of the eight self-contained breathing devices stored in sealed cabinets in the mill and maintenance areas. Forty Sherwood workers have been fully trained in the use of the emergency apparatus.

detection sensors, and should a fire occur, an alarm would sound in the guard shack, indicating the location of the fire.

Throughout all departments on both shifts, there are about 40 emergency medical technicians (EMT's), each trained by a full-time company instructor. Each month, the company holds EMT practice ambulance drills, dealing with a different medical emergency each time. Licensed by the state, the company's ambulance is equipped with a radio system tied into the mine's network as well as into a statewide system linking it to several participating hospitals, including the Deaconess hospital in Spokane where seriously injured Sherwood employees can be sent. On board is a portable electrocardiograph (EKG) machine with a cardiac defibrillator for emergency use in heart attack cases. This machine and a larger EKG unit in the first-aid station have already been instrumental in saving the lives of at least two Sherwood employees.

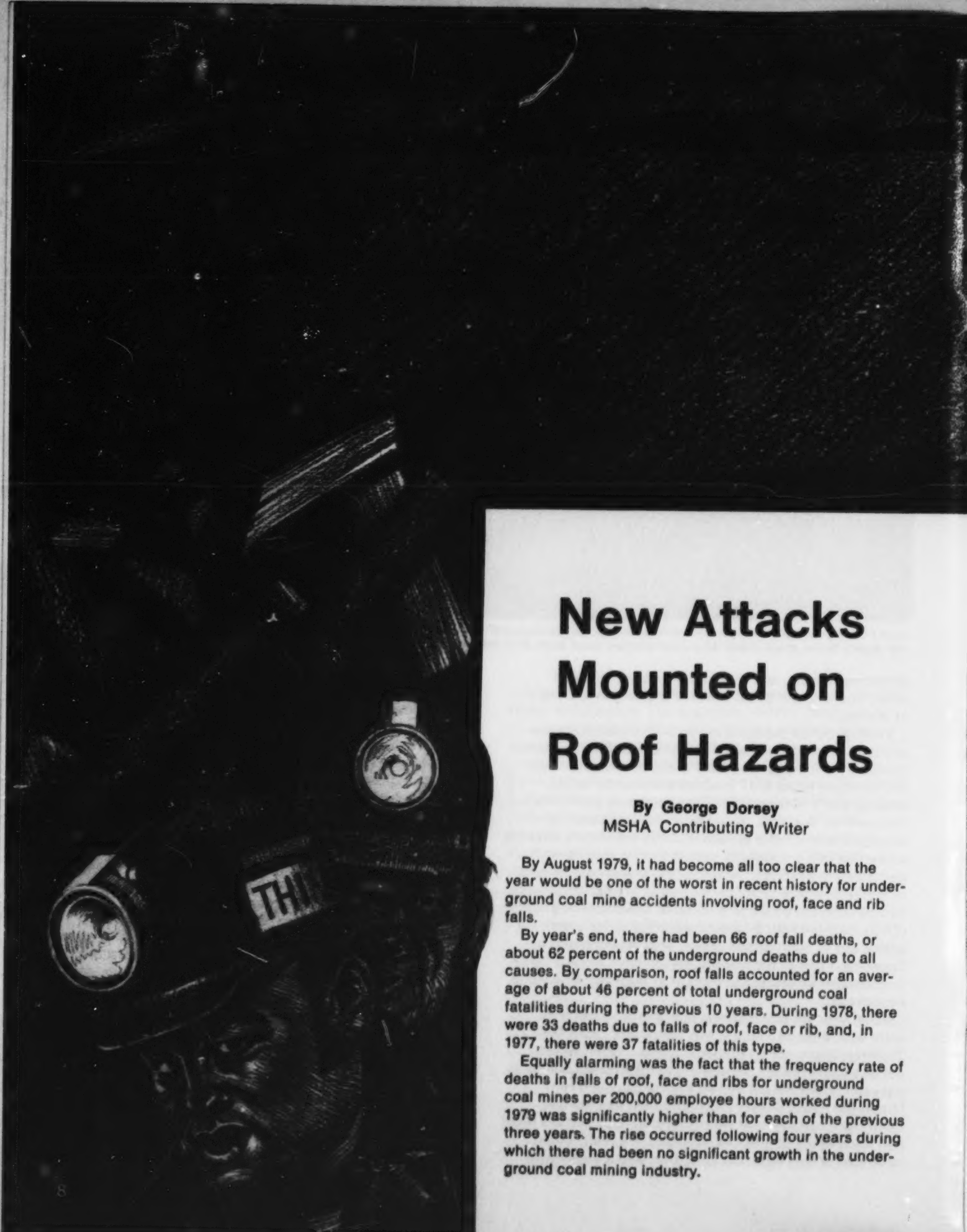
"Last year we had a shovel operator who came to work with what he thought was heartburn," said Mike Tredway, Sherwood's registered nurse. "When he ran out of antacid tablets, he came into the first-aid station to get some more; we put him on the machine and sent him to the hospital right away. The next day, he had open heart surgery, and we discovered later that his heart had been about 85 percent occluded. He really could have died at any time, but now, after about six months of recovery, he's back on his old job," he added.

Since then, another employee has undergone heart surgery after irregular heart rhythms were detected on one of the company's two machines, and so far, Tredway said, six employees have undergone further physical examinations because of questionable readings.

Under state law, Tredway is permitted to administer certain kinds of treatment and drugs under written orders from the company's part-time physician. All new employees receive extensive physical examinations and are questioned in detail on their medical histories, and Tredway gives annual hearing, eye and lung capacity tests to all employees. "We actually go far beyond what many companies do in this regard," Tredway said. "Keep in mind that for many people here, this is the first time they have really undergone any sort of medical examination at all. We try to gather as much information as possible, get what you call a baseline history."

Under the company's radiological health program, all mill employees must submit a sample for urinalysis each week, and every year, randomly selected mill workers are tested for internal radiation with a phoswich detector —a lead lined box with arms that scan the patient's body. Several samples for radon daughters , gamma radiation and dust are collected monthly at 36 locations in the mill area by the radiation safety officer, and so far, Fischer said, MSHA-collected samples have not exceeded recommended exposure levels.

(Continued on Page 28)



New Attacks Mounted on Roof Hazards

By George Dorsey
MSHA Contributing Writer

By August 1979, it had become all too clear that the year would be one of the worst in recent history for underground coal mine accidents involving roof, face and rib falls.

By year's end, there had been 66 roof fall deaths, or about 62 percent of the underground deaths due to all causes. By comparison, roof falls accounted for an average of about 46 percent of total underground coal fatalities during the previous 10 years. During 1978, there were 33 deaths due to falls of roof, face or rib, and, in 1977, there were 37 fatalities of this type.

Equally alarming was the fact that the frequency rate of deaths in falls of roof, face and ribs for underground coal mines per 200,000 employee hours worked during 1979 was significantly higher than for each of the previous three years. The rise occurred following four years during which there had been no significant growth in the underground coal mining industry.

Thus it was that the Mine Safety and Health Administration on Aug. 14, 1979 issued a memorandum addressed primarily to underground coal mine operators but calling for "immediate action on the part of all parties concerned with coal mine safety." The memo reemphasized actions and procedures required to protect miners from roof fall hazards.

Action took place on several fronts in ensuing months. An evaluation team began reviewing roof control programs in all Coal Mine Safety and Health districts to identify mines experiencing fatal roof fall accidents and to better focus on problem areas in the enforcement program. Roof control plans of mines having a high frequency of unintentional roof falls were evaluated for content and compliance with safety regulations. And a task force was formed to re-examine MSHA's entire roof control program and to develop action plans.

To better inform the mining community about accident causes and prevention methods, MSHA also began distributing "Coal Mine Fatal Alert Bulletins" to coal mine operators, labor organizations, operators' associations and to MSHA offices throughout the country.

The pressure to find solutions to the serious problem of increasing roof fall deaths continues this year.

On March 12, 1980, MSHA Coal Mine Safety and Health Administrator Joseph Cook convened a meeting of MSHA district managers and roof control specialists to form a special committee to study the adverse trend and to initiate a special emphasis program to attack the No. 1 killer in underground coal mines. Each of MSHA's 10 coal mine safety and health districts was asked to evaluate its own situation regarding roof, face and rib falls and to come up with an agenda of the measures it would take—an agenda to be submitted to MSHA headquarters.

Meanwhile, the Mine Safety and Health Administration has made several policy changes and is studying a broad range of other contemplated actions aimed at reducing roof hazards.

In April, Coal Mine Safety and Health district managers were advised to consider on a case-by-case basis where clearly applicable making wider use of citations under provisions of Section 104(d) of the Federal Mine Safety and Health Act of 1977 ("unwarrantable failure" to comply with a mandatory safety standard) to better enforce compliance with roof control regulations.

In addition, MSHA inspectors have been directed to issue citations under sections of the roof control and training standards when it is found that mine employees have not been adequately trained in roof control.

Herschel Potter, MSHA Coal Mine Safety Chief, recently said that, based on results of the evaluation team's survey, efforts are being made to improve communications among MSHA roof control specialists involved in the development of mine roof control plans, district managers, and inspectors. Specifically, inspectors and inspection supervisors who are familiar with individual mine conditions and deal regularly with mine management will provide more input than previously into roof control plans.

At the same time, efforts are under way to improve training of inspectors and supervisors in their roles of enforcing underground coal mine roof control regulations and approved plans.

Potter said MSHA also is emphasizing the increased use of findings during investigations of roof falls to require revisions of roof control plans which include the necessary additional supports.

Over the longer term, MSHA intends to draft proposed revisions of sections of Part 75, Subpart C of Title 30, Code of Federal Regulations, pertaining to underground coal mine roof control plans and programs, to reflect new technology and improved safety techniques. Among the possible regulatory changes being studied are those

Over the years, roof falls have been the leading cause of deaths and serious injuries in underground coal mines. Above, MSHA inspector supervisor Kenneth Fee is shown during his investigation of a roof fall in eastern Kentucky which killed one and seriously injured another miner.

dealing with the use of Automated Temporary Roof Support Systems (ATRS).

These systems are hydraulically operated support arms or bar-type devices raised against the roof prior to roof bolting operations, providing immediate ground support past the last permanent row of support. Considered an important advance in safety technology, ATRS systems are gaining increasing acceptance for use on roof bolting machines, and, to a lesser degree, on continuous miners.

The problems are not identical in MSHA's 10 Coal Mine Safety and Health districts and approaches to resolutions may vary from district to district. This article therefore concentrates on a single jurisdiction, District 4, which covers the 22 southernmost counties of West Virginia and encompasses the largest number of underground coal mines (476) in any district. District 4 deals with the safety and health of 35,000 men and women working underground—nearly a quarter of the Nation's underground coal miners.

The manager of MSHA's District 4 is James M. Krese, a confident man with 30 years' experience in the mining industry—as a miner, section foreman, mining engineer and mine manager. He became district manager in July 1973.

Of the 30 fatalities in District 4 coal mines in 1979, roof falls accounted for 15, compared to eight in 1978. By last summer, the adverse trend was unmistakable, and Krese took several specific actions. Among the measures he initiated, two would appear to have been particularly effective.

"First," he says, "I held a staff meeting, calling in the entire inspection force. We have 233 inspectors for the district. I asked them to spend more time at the face, paying particular attention to the roof. I told the inspectors, 'I want each of you to become a roof control enforcement officer.'

> *"I asked the inspectors to spend more time at the face, paying particular attention to the roof . . . I told the inspectors, 'I want each of you to become a roof control enforcement officer.' "*

"I emphasized the issuance, when justified, of unwarrantable failure citations in cases where the mine operator knew, or should have known, of unsafe roof control practices and conditions, for example, in instances when the company is not following the roof plan. This is serious business because a second unwarrantable automatically carries with it a closure order for the affected part of the mine.

"Second, we set up a series of information meetings, inviting representatives of management, the miners and the West Virginia Department of Mines. We discussed details of roof fall accidents and ways to prevent these accidents and injuries. The meetings were well received. We never had such a turnout before and it was very encouraging."

For the future, the District 4 people are pushing for greater use of Automated Temporary Roof Support systems (ATRS) which eliminate much of the human error involved in roof fall accidents. Eleven of District 4's 15 roof fall fatals during 1979 occurred in the face area.

At present, about 20 percent of the roof bolting machines being used in District 4 are equipped with ATRS. Krese says, "We are aiming for 100 per cent." Meanwhile, the state of West Virginia is moving toward promulgation of rules on ATRS use. The state held a public hearing in June on the proposed regulations.

One strong advocate of ATRS systems is Ken Peterson, a United Mine Workers of America safety inspector. "Injuries and fatalities come mainly when miners are setting temporary support—and usually when the condition of the roof has not been properly evaluated. But even if the roof has been checked thoroughly, its apparent condition may be deceptive. Sometimes it is hard to tell when it is unsafe. ATRS systems are truly life-savers."

Ron Scaggs, 36, a strapping six-footer who weighs in at about 210 pounds, is the safety director at the Beckley Mine, Glen Daniel, W.Va., part of that 20 per cent that uses ATRS. Scaggs is sold on the system, and says, in fact, that, without it, "we would be going backward instead of forward in mine safety evolution. Without other new technology, we could not have mined here. The geological formation is so poor that the Beckley Mine would have been unsafe to mine if it were not for fairly recent technological developments. But, with the protection of such techniques as resin grouted roof bolting, some 400 of the mine's 540 employees work underground mining some of the highest grade bituminous coal produced in the country."

There have been two roof/rib fatalities in the Beckley Mine since Scaggs became safety director in 1975. In neither case was it determined that violation of roof control requirements was a causal factor.

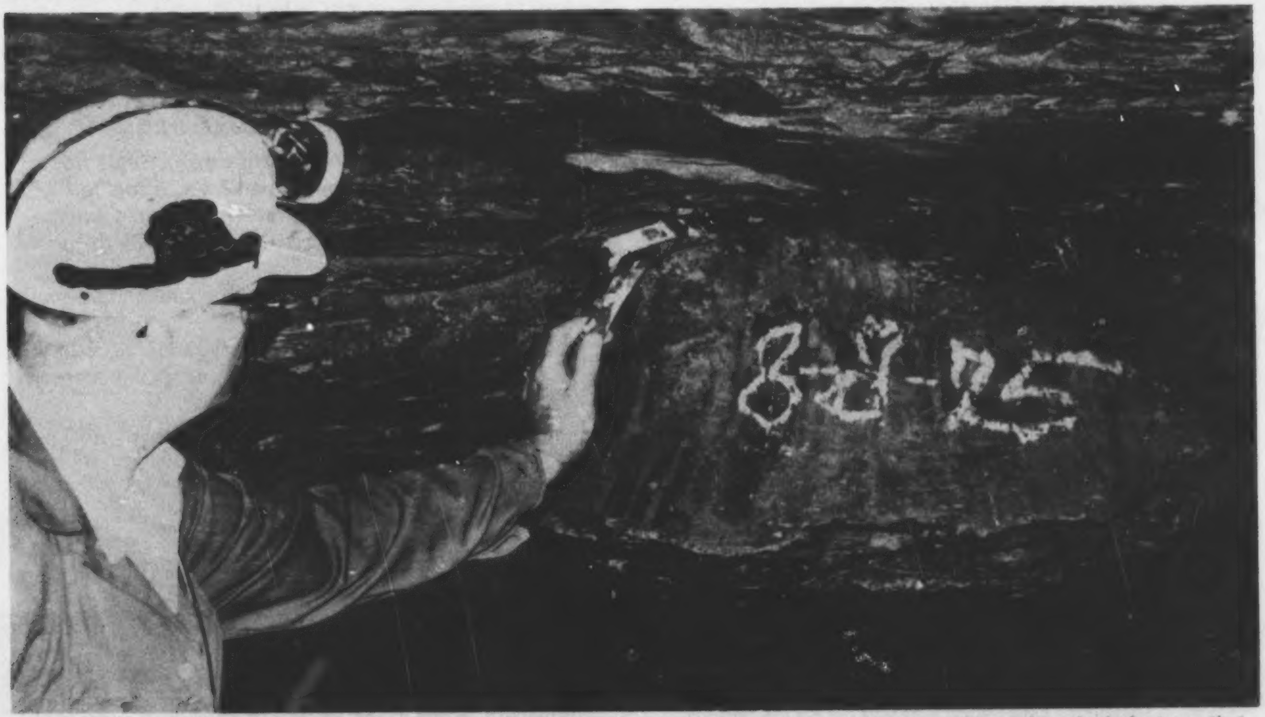
Scaggs, who has college degrees in both the humanities and mining technology, says the biggest problem for a safety director is "getting people to practice what they're taught." But he feels progress has been made.

"Repetition makes men become careless unless they are constantly reminded of the danger. There must be emphasis on constant alertness, and there is a need for retraining of the older miners."

"In general," he says, "miners take pride in mining, which, as everyone knows, is hard and sometimes dangerous work. A lot of people in this mine also take pride in doing a job safely.

"I write a weekly safety letter, citing recent accidents. Every Monday, each section foreman goes over it with the miners. Roof control is discussed at the beginning of every shift.

"The miners are reminded not to go beyond permanent supports except to set temporary supports—and then to first check the roof very carefully by sight and by sound/



"Concretions" or "kettle bottoms" such as the one being examined here represent one of the many types of geologic features that contribute to roof fall hazards. Concretions should be barred down, using a long-handled tool, to reduce risks to miners.

The occurrence of faults, or fractures in the earth's crust in which there is displacement of strata, can result in unstable roof conditions. The fault shown here was exposed at a surface mining operation. Strata on the right have moved downward relative to those on the left.

vibration. They are told to pull down loose rock, making sure first that they are standing under permanent supports."

UMWA safety inspector Peterson acknowledges that, in most situations, the union gets good cooperation from companies such as the one that operates the Beckley Mine. "But at some mines," he says, "the operators fight you at every turn. Managers merely read the roof plan. They should explain it to the miners and get their views. They should conduct physical demonstrations showing how to set supports."

District 4 has some problems, stemming from economic conditions, that do not exist in much of the rest of the country. "In the United States as a whole," says District Manager Krese, "more coal was mined in 1979, including both surface and underground operations, than ever before, but not in West Virginia. Here, we produce high-quality, metallurgical coal used to make coke for the steel mills. Reductions in steel production automatically affect the market for this coal. In the last year and a half, we've lost about a hundred mines to shutdowns causing the loss of many mining jobs in West Virginia.

The presence of protective cabs or canopies over operators of mining machines has saved the lives of more than 170 miners involved in sometimes devastating roof falls during the past six years, according to accident records.

The UMWA's Peterson says that the push to maintain production at some operations creates a work atmosphere that is conducive to taking shortcuts that can adversely affect safety.

On Thursday, Jan. 4, 1979, at 8:10 p.m., in Eagle No. 1 Mine, Riverton Coal Co., Powellton, W. Va., a roof fall accident which occurred at the face of the No. 4 entry, 2 left off Eagle mains sections, resulted in death to Harold Lee Wentz, section foreman . . . Wentz had 20 years' mining experience with eight years as a section foreman. —from the MSHA accident report.

Most mine accidents happen to the younger, less experienced miners. But not roof fall accidents—at least not in MSHA's District 4 last year.

In looking back on the upsurge in roof fall fatalities in the most recent full year, management, union and MSHA officials have noted that a very high percentage of the victims were men who had had a good many years on the job.

In terms of manhours worked, the occupational categories most frequently involved in accidents were: foreman, roof bolting machine operators, and continuous miner operators. It is easy to understand why miners operating machines at or near the face are vulnerable. They are working in the most recently exposed part of the mine. But foremen?

Three men who know mining from different vantage points recently offered random observations that together add up to a thoughtful appraisal of factors contributing to the frequency rate of accidents involving foremen and other experienced persons.

Buster Williams, underground superintendent for the Beckley Mine: "The foreman tends to develop the 'it won't happen to me' mentality. He has gone through a lot of years when it didn't happen to him, and he sometimes gets careless. The younger fellow is a bit scary, more cautious. He's keeping an eagle eye on that roof. He hasn't had time to become complacent."

Ken Peterson, the UMWA safety inspector: "I remember a recent case at another mine where a timberman failed to observe the top and removed a timber. A slab 15 feet long, five feet wide, and two feet thick fell and crushed him. He had been in the mines for 33 years. Repetition makes men become careless unless they are constantly reminded of the danger. There must be emphasis on constant alertness, and there is a need for retraining of the older miners."

Darlie "Andy" Anderson, a MSHA inspector who has spent 34 of his 55 years in the mines and was himself a section foreman: "There's a certain amount of the gambler in everyone, and I feel that foremen think they know more about the mine than anyone else. But more than that, courage is considered a part of leadership. The foreman wants to make a good showing in front of his people. He wants them to look up to him."

Several MSHA studies of coal mine accidents involving supervisors have indicated that a sizeable percentage were operating equipment or doing other non-supervisory jobs at the time the fatal accidents occurred. In one study of 61 supervisors at coal operations who were killed over a two year period, it was found that nearly 60 per cent of the fatal accidents occurred to foremen, assistant foremen, superintendents or others who had had more than 15 years of mining experience. Further, of the 61 fatalities, the largest number—13, or more than 21 per cent—occurred because of failure to support roof or rib.

The effect of weathering on coal mine roof. Where ground water has entered mine workings because of faults, weathering can occur rapidly, often resulting in roof falls.

Fossilized remains of prehistoric plants or animals are found in the first few feet of the immediate roof of some underground coal mines. A fossilized tree limb or large, heavy stump (above) can drop out of surrounding roof at any time. Where found, such remains should be considered hazardous and supported accordingly.

"When a fatality occurs, I am upset and disturbed. It's a terrible experience for the entire mining community."

Jim Krese's words seem to distill all he has seen, heard and felt in the 30 years he has been in and around coal mines in Pennsylvania, Kentucky and West Virginia.

"I've seen the miners who are physically handicapped for life because of injuries," he said "I try to get to all fatality investigations. I work with the investigation team. We want to do all that is humanly possible to cut down on the number of accidents."

Jim Krese is respected by miners, operators and the men he leads. But even though he himself is confident that he and his staff are doing all they can to create safe conditions, he is still hit hard when the word comes in that another miner has died in District 4. He gets, as he says, "upset and disturbed."

> *"I've seen the miners who are physically handicapped for life because of injuries . . . we want to do all that is humanly possible to cut down on the number of accidents."*

A man who works closely with him, Fred H. Ryan, the district's chief roof control specialist, says, "All MSHA people feel bad when someone is killed in the mines. If they don't, they shouldn't be in MSHA.

"What hurts is when you see afterward the little things that could have been prevented. The little mistakes someone made. You ask yourself, 'If only this had been done . . . If only he had been just one step back."

If . . .

Miner's Life Saved by Canopy

'It Just Gave One Quick Crack and Down It Went . . .'

By Frank O'Gorman
MSHA Staff Writer

At about 11:30 p.m. on April 24, 1980, at the Florence Mining Co.'s Florence No. 2 underground coal mine in Indiana County, Pa., Clyde W. "Billy" Waddell, 31, was operating a continuous miner for the final pushout of the pillar block between No. 5 and No. 6 rooms of the 1st south 024 section.

Without warning, a roof fall occurred, dropping many tons of rock on the Joy 11CM miner which Waddell was operating. The total fall area measured 20 feet high, 45 feet wide and 100 feet long.

For nearly 13 hours, Waddell sat in the machine, protected from the tremendous weight of the fall by the continuous miner's steel canopy overhead, before rescue crews could reach him. Removed from the mine on a stretcher, he was taken to a nearby hospital, where he was pronounced fit and released.

He was tired, he told reporters, not in pain, but "definitely" hungry. His wife accompanied him home from the hospital, happy to cook the big meal he craved, thankful for the canopy over the continuous miner which had saved her husband's life—doubly thankful for that canopy.

Waddell gave this description of the frightening events of April 24:

"I was going in to load the fifth buggy, cleaning up as I went in. The bits were almost at the face when someone flagged me. I hit reverse tram, and the next thing I knew, the roof was falling and the canopy set down about 2½ feet and pushed me down in the seat.

"It just gave one quick crack and down it went . . . All I heard was one big roar . . .

"After everything stopped, I could hear the men calling to me. I said I was okay and asked if my helper (Burl Knupp) was okay. They said everyone was safe, and they were going to start to clean up an area to get me out. I took the seat out of the compartment so I would have room to sit down."

With MSHA and state inspectors closely monitoring the rescue operation, alternate shifts of Waddell's fellow miners worked through the night and the following morning to remove the fallen rock.

Using chalk he always carried with him, Waddell marked several points on the canopy overhead and checked them repeatedly for possible movement that could indicate further settling or cracking of the canopy. He also passed the time drawing pictures of the position of the continuous miner before the roof fall occurred.

"At one point," he told reporters afterward, "I could see their lights and then all those rocks fell down again. That was the longest part, waiting to see that light again."

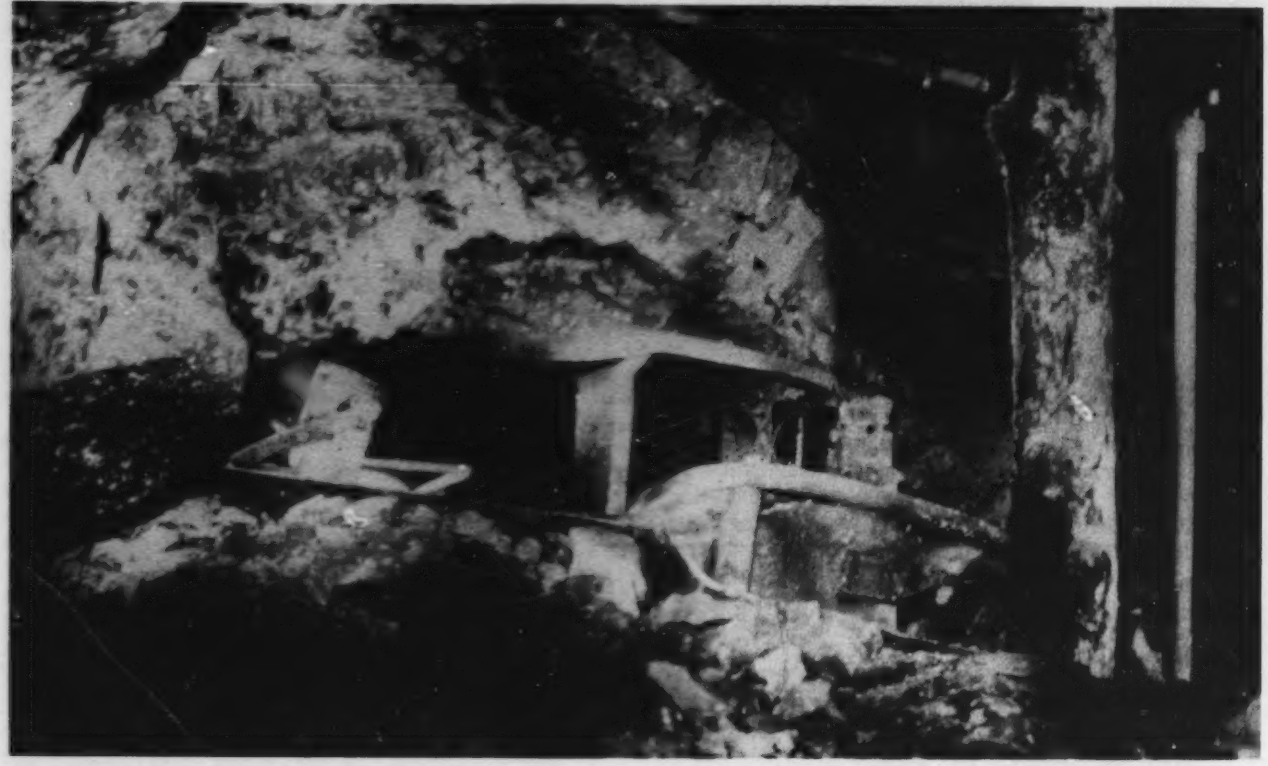
MSHA inspectors George Beatvina and Greg Turner examine a mine map of the area of a roof fall which trapped miner Clyde Waddell before they enter the mine near Johnstown, Pa., at the start of the rescue operation.

Rescued miner Clyde Waddell responds to cheers from co-workers as he is carried out of Florence No. 2 Mine on a stretcher.

The rescuers used a hand drill to enlarge a hole into the pile of debris so that the trapped miner would have sufficient air and could communicate with miners clearing away the debris. Waddell remained in good spirits throughout his ordeal.

Finally, Waddell saw a hand reaching toward him. Shortly after that, rescuers pulled him through a hole in the rock mass.

"This is the second time that a canopy has saved my life," Waddell said, "and I think the canopy is the best thing that was ever put on mining equipment." He had been under another canopy in a Joy 11CM on May 23, 1973 when the roof collapsed, and he had also walked away from that one unharmed.



The continuous miner in which Clyde Waddell spent nearly 13 hours under protection of a canopy before rescuers could reach him following an underground coal mine roof fall. Part of the fallen material which had surrounded the machine has been cleared up by the time this photo was taken.

Regulations requiring the use of cabs or canopies on electric face equipment became effective in 1974 in coal mines having mining heights of 72 inches or more. In six-month increments thereafter, the regulations became effective in mines where the mining heights were less than 72 inches. The regulations were suspended where mining heights are 42 inches or less.

Waddell is not alone in his debt to the protective cabs and canopies over operators of mining machines. From 1974 to the present, there have been more than 170 reported cases of roof fall accidents in which miners' lives were saved by cabs or canopies.

Two days before the Florence No. 2 Mine accident, Andrew Galko, a continuous miner operator at Bethlehem Mines Corp.'s Revloc Mine 32, in Cambria County, Pa., was involved in an accident that could have been, but wasn't, disabling or fatal.

While tramming his miner in reverse, the machine rubbed against two crossbars used for permanent roof support. Seconds later, a piece of rock five feet long, 3½ feet wide and six inches thick fell directly on top of the canopy. Galko later said that the canopy had saved him from death or serious injury, that it was the second time he had been saved by a canopy, and that he would not operate a continuous mining machine without one.

And on May 5, 1980, at the Florence No. 1 Mine, Robinson, Pa., Donald McFeaters was rescued unhurt after a roof fall buried the Joy 11CM continuous mining machine he was operating. Both McFeaters and mine employees who had observed the accident acknowledged that the miner's life had almost certainly been saved by the presence of the canopy.

For some miners whose lives have been saved by cabs or canopies, the waiting period before being rescued is relatively brief. For others like Waddell, the wait can take hours. But for all miners who have spent time under tons of fallen roof insulated from harm only by the steel plate overhead, the fact that they are alive is akin to a miracle.

Using the light from their cap lamps to find their way, five participants in a coal mining orientation course for women make their first "duck walk" into a "low coal" area of a simulated mine at the Hazard, Ky., State Vocational-Technical School. Today, more women are seeking coal mining jobs than ever before.

'Treat Men With Respect; Respect Yourself'

Training Seminar Eases Pathway Of Women Entering the Coal Mines

By Debra Howerton
MSHA Staff Writer

When "Queen of Country Music" Loretta Lynn sang, "I'm proud to be a coal miner's daughter," she was remembering a time when Daddy raised eight kids on a miner's pay while Mama stayed home and took care of them. Times are changing.

Today, backed by the Coal Employment Project (CEP) and other women's support groups, more and more females are breaking through time-worn barriers to take their places next to men in the male-dominated field of mining. With children to feed and bills to pay, many women in coal mining regions of the country no longer can, or want, to stay home. They are tired of welfare; they are tired of poverty; they are tired of low self esteem. Even the ones with working husbands are tired of complete financial dependence. They want better for their children, and they want better for themselves.

Because one common employer complaint is that women are not qualified to work in the mines, CEP directs part of its efforts at training.

"Our sole purpose is to help women get and keep jobs in coal mines," Assistant Director Joyce Dukes explained. "Training is just one facet of this. We want to see to it that they *are* qualified." In Kentucky, the state Bureau of Vocational Education recently funded four 15-hour orientations to entry level coal mining training, designed and presented for women by the CEP at vocational schools in Madisonville, Whitesburg and Hazard. As an introduction to the regular 56-hour safety training for new miners required by the state, the seminars included panels of working women miners, plus sessions on tool identification, physical conditioning, sexual harassment, assertiveness and legal rights.

"From the 40-hour pilot program presented in Tennessee, we took what we thought was the best part and brought it to Kentucky. We believe this program will help you start thinking of yourselves as miners," Dukes told the 20 Hazard participants.

Although upon completion of the training, the women received mining papers after completing training which would allow them to begin work at an entry-level position, they were not guaranteed jobs. According to James Baker of the Kentucky Board of Occupational Education, today's depressed market has forced many experienced coal miners out of work.

"It will not be easy, but for women there are no obstacles that cannot be overcome," he said. "When you do get hired, you'll have problems with myth, problems with being able to handle teasing, and problems with how you and your husband will deal with your working underground with men all day.

The panel stressed to the class that the work is not easy. They explained their jobs, then fielded questions on everything from safety and personal hygiene in the mine to communications, working relationships, and the actual physical requirements.

"You might as well accept that the company will have no humanitarian feelings about this," Baker continued. "Your growth and development as a miner will depend on what you put into it."

The panel agreed, and added that even landing a job can be a test of ingenuity and patience. Faye Caudill, a two-year veteran of the Blue Diamond Co., was unemployed and living with her parents when she decided to become a miner. After submitting six applications to the company with no results, she was desperate. So when she discovered that the mine superintendent drove past her parents' house every day on the way to work, she waited by the side of the road and flagged him down.

"It's comical, now that I look back on it. I explained my circumstances and he was kind enough to take my application in to the office," she said. Shortly, she was called for an interview and hired.

"My daddy was always a coal miner. I guess the last thing he expected was to have his daughter become one," Caudill said. "But with my lack of education, I couldn't see any other way to make enough money to support my three kids."

Several participants were also from coal mining families, but few had actually been underground. Therefore, the Hazard Vocational-Technical School's new 120-foot by 170-foot simulated mine provided them the opportunity to experience—if only vaguely—what an underground mine is like. The $485,000 concrete structure, the second of its kind to be completed in the state, is used in all mine safety and mine mechanic training programs at the school.

"I wish I would've been fortunate enough to have this class. The only training we had was at the mine," Betti York, veteran of three years underground with Blue Diamond Co., said. York, 48, worked all her life to support 10 children, but had never been inside a mine when she first came to work.

"When I was hired, I was told, 'We're hiring you equal to a man. Do you feel like you can do it?' I said, 'If I find out I can't, I'll come to you. You wait and see.' I never went back to that office," she recalled.

The panel stressed to the class that the work is not easy. They explained their jobs, then fielded questions on everything from safety and personal hygiene in the mine to communications, working relationships, and the actual physical requirements.

"When you go in there, you go in there ready to work. You don't go in with your hair fixed and makeup on," York said. "It's not like when you're at home where you work a little, then sit down and have a cup of coffee. They want me to pull my part, and I do. You have to let the company know you're there to work and to learn."

Marat Moore, 26, an unemployed miner currently compiling information for a book on women in coal mining, described her seven-month stint underground with U.S. Steel in West Virginia as a "love/hate relationship.'"

"I loved it and hated it at the same time, but I had pride in the work that I have never felt before," she said. "Mining gives you the chance to develop a whole new set of instincts that you never knew you had. I'll go back."

Underground, Moore said, miners develop a trust in each other. But with this trust comes responsibility for lives—yours and those of your fellow workers.

"The neat thing about being underground is that there is a bond. You work together," Brenda Brock, miner with Eastover Co., said. "But it's not easy. Some men resent that women can walk in and take their places, and others think you're only in a mine to catch a man.

"These have been the hardest two years of my life—physically, mentally and spiritually. It's been a hell of a trial," she said.

In spite of the physical strain of the work and the frustrating effort of trying to gain acceptance as an equal among men, the four women miners said they have encountered no job too difficult to learn, as long as there is someone willing to teach.

"I love my job. Right now I'm working on a belthead, but I've worked on a miner, and I've bolted and rock-dusted," Brock said. "The pay and the benefits are good. In three months I'll have my first baby and I don't have to worry about a thing. For the first time in my life, I'm happy and I'm secure."

As pioneers, the 2,500 women now employed by coal companies throughout the country are overcoming major obstacles, making the way easier for those who follow. It is hoped that through training programs geared to women, much of the trial and error earlier encountered underground will be put to rest in the classroom. A few mining companies have incorporated special workshops for women into their regular training programs, but some observers say there is much room for improvement throughout the industry. In the meantime, it is important, the miners agreed, to keep the situation in its proper perspective, realizing that change will be slow, but not impossible.

Andrew Messer, mine safety instructor at the Hazard, Ky, State Vocational-Technical School, briefs Geraldine Spencer, left, Shirley Overbee and Margaret Noble before leading them through the school's simulated underground mine. Classmates await their turns.

They insist that as time goes by on the job, sex ceases to be an issue because, as they put it, "the roof is going to fall on you whether you're a woman or a man."

"I've been in the mines three years, and I've never had one man say anything personal to me. You will command respect if you treat the men with respect and if you respect yourself," York said. "Deciding where you're going to go to the bathroom or how to find shoes that fit are minor problems. Safety is the important thing underground

"I loved it and hated it at the same time, but I had a pride in the work that I have never felt before," she said. "Mining gives you the chance to develop a whole new set of instincts that you never knew you had. I'll go back."

"You will soon find that the most important thing is not dealing wtih yourself as a female. Everyone knows these human differences exist. The most important thing is becoming a miner," she said. "I'm proud to be a coal miner."

For Some Women, Mining Is 'Only Chance'

After endless winding, climbing and turning, along precisely the correct Kentucky roads, one eventually happens upon Hazard. It's like other towns in that quiet land of beautifully green hills, harboring tiny cabins whose puffing chimneys are the only signs of life inside. Nestled in cozy valleys, the homes are decorated with laundry drying among hanging potted plants on the porches. Their blackened, frame exteriors contrast with the clean countryside, as if the coal that is the state's lifeblood seeps through the boards.

Despite the serenity of its countenance, Hazard has not escaped 1980. Nor have its people escaped the hassles and pressures of the times . . . the soaring divorce rate, inflation, unemployment. And the coal that is the state's lifeblood is theirs, too.

"It's our only chance. There's nothing else to do. No other way to make money," said one student in a 48-hour state mine safety training course, which qualifies participants for entry-level positions in coal mines. But the 20 students in this particular program had something other than unemployment in common. All were women.

These women are evidence of a struggle that embodies the American ethic. Theirs is a struggle for economic independence. They want something they have never had . . . financial reward for hard work and control over their own lives. In the coal miner training, they glimpse a chance.

Dorinda Moss has lived in Eastern Kentucky all her life. Separated from her husband, she supports two children and a diabetic mother on $100 a month.

"I'm trying to survive, that's why I'm here," she said. It's not that she hasn't tried. Moss completed the secretarial courses offered at the vocational school, but since there are no secretarial jobs, she feels her time was wasted. And even if there were jobs, they wouldn't pay enough to do her much good.

Bethel Campbell has already reared her seven children, but with a disabled husband in and out of veterans hospitals, she needs more money.

"I work as a cook for the board of education, but I thought that, if I could get into something that could help my husband and pay the medical bills , I should do it," she explained. "I want to be a coal miner."

These are a determined people, dedicated to their families and sincere in their efforts. Their wants are modest, and they have no intention of giving up. Again and again, their purpose was sounded: "I never had much of a life. I want to do something by myself, to make me feel better." "I want to make my own way. I don't want to ask for nothing." "I want better for my children."

Sandra Shepherd, 28, supports four children, ages seven through 12, on $275 a month Aid for Families with Dependent Children. Her rent payment alone is $150 a month. Having held jobs for General Motors, a steel company and a casket company, mining would not be her first attempt at a male-dominated occupation.

"My father was a coal miner, and my stepfather retired from the steel mills," she said. "My mother didn't really want me to do this at first, but they don't say too much because they know it's all I can do to make money. It's the best I can do to support my kids."

Shepherd says she enjoys physical labor, and that she is not suited to waitressing, or any of the jobs commonly open to women in the area.

Margaret Noble, of Bonneyman, Ky., works on her coal-shoveling technique to gain familiarity with tools and procedures during an introductory program on coal mining designed to help women get and keep jobs as entry-level coal miners.

"Coal mining is something I've always wanted to do. I've heard it's scary, but I'm not scared," she said. "I need the money because I'm raising four children by myself, and as long as God gives me the willpower I will work."

Bound by a common cause and strengthened by a growing support network, for the first time in many of their lives, these women believe in themselves and their futures.

"I've always done everything for everybody. Now I want to do something for myself," Vernia Engle, 28, said. "I believe in going out into a man's world. Whatever it takes, I believe in going out there and holding your head up and doing it."—**D.H.**

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Mining Schools Move to Strengthen Emphasis on Safety, Health Courses

Left to right, Dr. Jack Reed, Indiana University of Pennsylvania; Dr. Robert Lauda, also of IUP; and Timothy Shaw, of Virginia Polytechnic Institute, shown during an April conference of mining educators and MSHA officials which was called to discuss the role of mining schools in developing stronger mine safety and health programs.

By Katharine Snyder
MSHA Staff Writer

Twenty-four mining educators from universities across the country met with top MSHA personnel at the National Mine Health and Safety Academy in Beckley, W.Va., April 7-8, the first time such a group has come together to discuss the role of mining schools in strengthening safety and health protection for the Nation's miners.

Participants in the conference represented 21 universities in 17 States, including more than two-thirds of all U.S. institutions that offer degrees in mining engineering.

The MSHA representatives included Assistant Secretary of Labor for Mine Safety and Health Robert B. Lagather; Deputy Assistant Secretary Eckehard Muessig; Thomas J. Shepich, administrator for Metal and Nonmetal Mine Safety and Health; Joseph A. Lamonica, assistant administrator for Coal Mine Safety and Health; Donald P. Schlick, director of Technical Support; Dr. Michael G. Zabetakis, superintendent of the Academy; and John C. English, deputy director, Education and Training.

"This is the first time that all of us are here in one room, the leading mining educators in the country and the enforcement administrators," said MSHA's Kuppusamy Thirumalai, organizer of the conference, in opening the meeting. It was a unique opportunity for both groups to learn about each other's resources, share experiences, discuss problems and suggest solutions.

In the first session of the conference, the MSHA administrators described agency activities and their current perspectives on university-level mine safety and health education. In the second part, coordinated by Dr. John Sturgul of New Mexico Institute of Technology, representatives from each university outlined their institutions' programs in safety and health. A tour of the Academy facilities was given. Discussion followed many of the presentations and continued between formal sessions. On the second day, Dr. Thomas J. O'Neil of the University of Arizona chaired a wrap-up session which identified a number of specific ways in which MSHA and the universities could usefully expand their cooperation.

Assistant Secretary Lagather established a major theme of the conference when he led off with an appeal to the universities to give greater emphasis to safety and health throughout their mining engineering programs. "You get these young people in their formative years," he said, "and, if you build into your programs that safety and health is an absolutely essential part of mining itself, that attitude will carry over when they leave those schools, and when they go out to eventually become superintendents and managers of mines. It's the creation of an attitude; when you give the same importance to safety and health as you give to technical training courses, it's going to pay off."

As representatives from each institution responded in their presentations, agreement was clear that every mining engineer needs an understanding of health and safety matters. However, their specific programs varied. Some of the mining engineering schools concentrated on supplying the needs of a local mining community; others covered many different minerals and mining methods. Some mining engineering departments date back to the 1800's and draw on long traditions; others have been recently established in response to growing minerals demands. Some offer continuing education courses for miners and extension services for industry as well as mining engineering. A few have developed innovative mining programs. There is variety also in the emphasis given to safety and health subjects and in the methods used to teach them.

A number of participants in the conference emphasized the presentation of health and safety as an integral part of various technical courses.

"It's very difficult to talk about roof control and rock mechanics without getting into technical considerations of safety," said Dr. Richard Lucas, head, Department of Mining and Minerals Engineering, Virginia Polytechnic Institute. "It's very difficult to talk about mining ventilation without getting into the safety aspects of it. It's very difficult to talk about mining explosions, methane explosions, without getting into safety. The same thing with coal dust explosions and dust control. A whole host of issues is involved in a number of courses that the typical mining engineering student takes."

In some mining engineering departments, this treatment within technical courses is virtually the only exposure which students have to safety and health. The majority of those represented at the conference, however, also had other ways of involving students with these subjects.

A few schools—VPI among them—require all their mining engineering students to take a course specifically dealing with health and safety. Several others have such courses available as options. Short courses and lectures on safety and health are presented from time to time by state and federal mine inspection personnel or by company safety directors at a number of universities. "We have the MSHA Subdistrict and District offices in Birmingham," said Dr. Richard Sanford of the University of Alabama, "and we've taken advantage of them for short courses."

Engineering students are increasingly being encouraged to participate in cooperative work-study programs at least to take summer jobs in mining. This not only forestalls the problem—described by Dr. Robert Reeder of the Colorado School of Mines—of the "student who got into fourth year before he had to go into a mine, and found out he was afraid to be underground." It gives a practical meaning to what is taught in the classroom. "The graduates from a cooperative program will be among the most mature students you have," Lucas said.

Another advantage of work-study programs is that the students must receive the training in many aspects of health and safety which MSHA requires of all new miners. This kind of training is also of value for students whose course work takes them underground on field trips; the University of Missouri requires all its mining engineering students to take MSHA's 40-hour training for new underground miners in their sophomore year.

Is the safety and health teaching which is currently provided adequate for mining engineering students? The answer seems to be that some students are getting more adequate exposure than others, and that many mining engineering departments would like to expand in this area. This is especially true in the field of health, a subject which is getting increasing attention in the industry. Currently, most students are learning engineering means for controlling a few basic health hazards: dust, noise, radiation. But as Thomas Shepich said, "It's one thing to understand how to control hazards and to follow the regulations. It's another thing to understand why." And few students receive even basic instruction in health fields that are currently opening up, such as toxic substances, human relations, and human engineering. Although many schools would like to expand the health instruction given to mining engineering students, it may not be easy to do so.

MSHA's Kuppusamy Thirumalai raised the question, "In the universities, would there be a problem if you were to make a course on health for the mining engineers?" The answer came:

"No . . ."

"Honestly, I don't think so . . ."

"Other than taking something out of the curriculum to put it in . . ."

"That's a problem."

The problem in many cases is that mining engineering departments, by the rules of the universities as well as the limits of practicality, can only require a certain number of courses for the bachelor's degree. Further, mining engineering departments must meet stiff requirements to receive accreditation by the American Board of Engineering and Technology (ABET), virtually essential for their survival. This means that many departments have difficulty making space in the curriculum for a new course.

Other bars to such courses at some schools include a dearth of appropriate textbooks and a shortage of staff. "We could teach more health and safety," said Dr. Clark Mangeldorf of the University of Pittsburgh, "if we had additional faculty."

An important point, however, that several speakers made in discussions was that simply adding more credit-hours and information on health and safety will not be adequate. Students need to understand the human impact of the decisions on safety and health matters they may be responsible for making as professional engineers, the philosophy behind the regulations.

"It seems to me," said Dr. Barry Brady of the University of Minnesota, "that you have to operate on two levels. You have to establish a set of principles in terms of the legal and social and ethical framework in which the mining engineer has to operate. And on top of that, we're also bound to establish a set of solutions: 'This is the way to do it, these are the answers.' It seems to me a lot of undergraduate education in some places

Robert Franz, of Pennsylvania State University, makes a point during a meeting of MSHA officials and mining educators on how best to develop new approaches to the teaching of mine safety and health subjects to future mining engineers and others.

revolves around the latter without sufficient consideration of the former."

Failure to grasp the human significance behind the technical details can lead to tragic results. "I have never been a mine manager at a mine where there was a disaster," said Lucas of VPI, "but I have known two men who were, before and after the disasters, and they were never the same men again."

> *"Remember good old Joe? He couldn't do the job underground any more, and you needed a place to put him, so you put him in the safety department—a dead-end job. But now we've seen a change, and safety people are up there in the highest levels of management."*

In addition to the need for safety and health training for all mining engineers, a second theme also ran through the conference: the increasing need in the mining industry for professionals specializing in safety and health.

"Remember 'good old Joe?' " asked Reeder of the Colorado School of Mines. "Good old Joe couldn't do the job underground any more, and you needed a place to put him, so you put him in the safety department—a dead-end job. But now we've seen a change, and safety people are up there in the highest levels of management."

The need is particularly acute in the field of health. "The mining industry is totally devoid of expertise in health as it relates to coal mining," said MSHA's Joseph Lamonica. "There have been attempts to take mining people and train them in industrial hygiene. There have been attempts to take industrial hygienists and train them to know something about the mining industry. It's a very complicated problem. In our agency we've tried it both ways. I can't recommend one way over the other."

At West Virginia University, according to Syd Peng, of the College of Mineral and Energy Resources, mining engineering students can choose a concentration in health and safety. But this is an unusual option, and relatively few choose it. In most cases, students must wait for graduate school to do specialized work in this field. In this period of high demand, however, most students choose to go to work at the excellent salaries available in the industry, rather than staying to complete further education.

Indiana University of Pennsylvania is one university which is trying an interdisciplinary approach to producing mine safety and health professionals. Students take both industrial hygiene courses and mining courses for a bachelor's degree in Safety Management with a concentration in mining. An internship with a mining company is provided as part of the degree. "This is our third year of NIOSH funding," said Dr. Robert Lauda, chairman of the Safety Sciences Department. "We have 80 students in the mine safety management program. The first ones will graduate this May. Industry's very interested; in fact, one of our students is already working for the company where he did his internship."

Pikeville College in Kentucky offers a two-year associate's (A.S.) degree in mining designed around the training requirements under the 1977 Act. "About a third of our graduates have achieved supervisory status," said Dr. Maurice Bailey of Pikeville. "The whole focus of the program in the beginning was on developing young people for leadership roles in health and safety in coal mining. The industry, from what we've seen, really wants people like this. We've had no problem placing our graduates."

But graduates from existing programs apparently come nowhere near to filling the demand for mine safety and health specialists, who are needed not only in industry, but in government, labor and the academic community itself. Government grants already support several academic programs, and this conference led to identification of a number of other ways MSHA and the academic community might profitably expand their cooperation,

- The two groups could work together to develop new outlines and textbooks for college-level mine safety and health courses.
- Government might provide fellowships or internships for students who specialize in mine safety and health.
- Safety and health research program could be designed which would attract graduate students into the field.
- Cooperative seminars could be arranged.
- The academic community could participate more actively in review of prospective regulations.
- A personnel exchange program might be instituted.

"It's been a good get-acquainted session," said Dr. Earl Hoskins, of Texas A & M University. It was clear, however, that the conference had barely scratched the surface of the subject matter at hand. Most participants seemed to feel that further meetings would be of value. Accordingly, Assistant Secretary Lagather after the conference named a panel of six educators and three MSHA officials to make recommendations on a number of suggestions raised at the meeting, including further conferences.

"I feel that it has been a very good conference," said Dr. Thirumalai afterwards. "It has opened up excellent possibilities for cooperation between MSHA and the mining institutions to cooperate in improving the health and safety of mining operations. We have learned a great deal from each other and I hope we will continue to learn."

About 100 friends and relatives of the 91 miners who died of carbon monoxide poisoning following a fire at the Sunshine Mine, Kellogg, Idaho, gather at the Sunshine miners' memorial to honor the victims on the eighth anniversary of the tragedy.

Metal/Nonmetal Rescue Contest Scheduled Aug. 28 in Dallas

The 1980 National Metal and Nonmetal Mine Rescue Contest will be held Aug. 28 at the Convention Center in Dallas, Texas, where the best mine rescue teams from all over the country will compete to determine the national champion.

"Mining companies send their teams to the nationals to reward them for doing a difficult job well," J. D. Pitts, contest secretary, said. "This participation in national and in regional competition helps assure that teams will be well trained and ready to render assistance in case of a mine emergency."

Any organization, union, club or local benefit society may enter a team, provided that all members are bona fide employees of the metal and nonmetal mining industry. There are no limitations on the number of teams submitted from any state, company or organization, and competitive position is not a requirement for entry.

The national metal and nonmetal mine rescue contests are held on even-numbered years at various locations throughout the country. Twenty-one teams participated in the 1978 contest in Las Vegas, Nev., and the winning team was from the Diamond Crystal Salt Co.'s Jefferson Island Mine at New Iberia, La. According to Pitts, the Mine Safety and Health Administration sponsors the contest as a means of promoting mine rescue as an activity in the industry.

"We send out about 100 invitations to metal and nonmetal companies, but any team may enter until the day before the contest," he explained. Entry blanks are available at all MSHA Metal and Nonmetal Mine Safety and Health district offices and from MSHA training centers. The entry blank accompanying this article also may be used. To appear in the official program, entries must be submitted in writing or by wire to Metal and Nonmetal, MSHA, Room 702, 4015 Wilson Blvd., Arlington, Va., 22203, on or before Aug. 1.

Registration of teams, judges and contest officials will take place outside the Grand Hall of the Convention Center, between 1 and 6 p.m. Aug. 27.

Each team will be judged on its ability to solve a practical mine rescue problem and on a written examination. All judges will be trained in the assembly, use and care of the mine rescue equipment and procedures used. They will not be connected with any of the teams, teams' employers or equipment manufacturers involved in the competitions. Winners will be announced at a banquet following the contest.

On or after Aug. 1, contest equipment may be forwarded to Greyhound Exposition Services, c/o Space Center, 5200 East Grand Ave., Dallas, Texas 75223, where it will be held in security. Shipping costs should be paid in advance, and all boxes and cartons should be clearly marked, "Hold for National Mine Rescue Contest."

For additional information on contest rules, guidelines and procedures, contact MSHA's Metal and Nonmetal safety division, (703) 235-8647, or the nearest MSHA Metal and Nonmetal Mine Safety and Health district office.

ENTRY BLANK

1980 METAL AND NONMETAL MINE RESCUE CONTEST

To avoid the last-minute rush, please mail entries as soon as possible to:

Thomas J. Shepich
Assistant Chairman
National Metal and Nonmetal Mine
Rescue Contest
Mine Safety and Health Administration
Ballston Tower #3, Room 702
4015 Wilson Boulevard
Arlington, Virginia 22203

Please enter the following team in the 1980 National Metal and Nonmetal Mine Rescue Contest to be held at the Dallas Convention Center, Dallas, Texas, on Aug. 28, 1980.

Name of Company ....
Address ....
....
....
Phone ....
Name or Number of Team(s) ....
....
Name or Number of Mine(s) ....
....
Address ....
....
....

Team Personnel:

Please record names of captain, patient and substitute on lines designated.

1. .... (Captain)
2. ....
3. ....
4. ....
5. ....
6. .... (Patient)
7. .... (Substitute)

Hearings on Miners' Role in Dust Sampling Reset for August

MSHA will hold public hearings in August on the proposals to significantly increase participation of miners in the respirable dust sampling program in coal mines. Originally planned for July, but rescheduled so as not to conflict with the miners' vacation period, the new hearings will be held on August 12 and 14, 1980. MSHA will receive testimony at the hearings concerning proposed revisions to the coal mining regulations which would provide for miner participation in the sampling of coal mine dust in underground and surface coal mines and in the sampling of underground coal miners who show evidence of pneumoconiosis.

Hearings will begin at 9 a.m. local time at the following locations:

August 12, 1980—Bureau of Mines Auditorium, 4800 Forbes Ave., Pittsburgh, Pa.; and Holiday Inn North, Burley Room, I-75 and Newton Pike, Lexington, Ky.

August 14, 1980—University of Charleston, Geary Student Union Building, 2300 MacCorkle Ave., S.E., Charleston, W. Va.; and U.S. Post Office, Main Office Building, Room 269, 1863 Stout St., Denver, Colo.

Interested persons may request to make oral presentations at the hearing by writing to MSHA, Office of Standards, Regulations and Variances, 4015 Wilson Blvd., Arlington, Va. 22203, no later than August 8, 1980. The rulemaking record on the miner participation issue will remain open until Aug. 29, 1980.

Legal Briefs

Charles W. Miller vs. Old Ben Coal Co., FMSHRC Docket No. LAKE 79-282-D, decided March 17, 1980.

In a discrimination suit filed by Charles W. Miller against the Old Ben Coal Co. under section 105(c) of the 1977 Act, the administrative law judge ruled that the activities alleged by Miller did not amount to safety complaints but constituted disobedience of supervisory personnel. In reaching his decision, the administrative law judge said that the incidents alleged by Miller were not covered as protected activities under the 1977 Act and that they had occurred within three months of Miller's discharge.

News and Notes

Conrock Co., vs. Secretary of Labor, FMSHRC Docket No.'s WEST 79-373-RM and 79-374-RM, decided March 24, 1980.

Conrock contested two citations issued by MSHA for excessive noise exposure, arguing that personal protective equipment, in this case, ear plugs, satisfied the noise standard. Conrock said, in part, that MSHA should measure noise levels reaching the employee's ear. The administrative law judge ruled that the regulation requires that personal protective devices can satisfy that standard only after administrative and engineering controls have failed. Since engineering controls which would satisfy the standard were available to the company, the contests were dismissed.

Secretary of Labor vs. Concrete Products, Inc., Et Al, U.S. District Court for New Mexico, Docket No. 78-422, Civil, decided March 26, 1980.

Four separate suits brought against sand and gravel operators who had denied entry to MSHA inspectors were consolidated in this action. District Judge H. Vearle Payne ruled that warrantless inspections of sand and gravel operations under the 1977 Act met the standards of reasonableness and pervasiveness set forth in the 1978 Supreme Court decision in Marshall vs. Barlow's, Inc.

Secretary of Labor vs. Kniseley Coal Co., U.S. District Court for the Western District of Pennsylvania, Docket No. CA 80-139, decided March 14, 1980.

The Secretary sought injunctive relief against a coal mine operator when the operator denied entry to a MSHA inspector on three separate occasions. The operator argued that since the mine was family-owned and operated, it was not subject to the 1977 Act. Since provisions of the 1977 Act are limited to "each coal mine . . . , the products of which enter commerce, or the operations or products of which affect commerce," and because the administrative law judge found that the mine in question did affect commerce, he ruled the mine was subject to inspections under the 1977 Act and granted the Secretary injunctive relief.

Climax Molybdenum Co. vs. Secretary of Labor, FMSHRC Docket No. WEST 79-325-RM, decided March 31, 1980.

The administrative law judge vacated a citation for unwarrantable failure issued by MSHA on the grounds that the causes for a fatal accident which formed the basis for the citation were erroneous. The company was cited by MSHA for failure to maintain the braking systems of a haulage truck that went out of control on a decline, overturned, and fatally injured the operator. MSHA Technical Support personnel who later investigated the accident had determined that the brakes had been adequately working at the time of the accident, but said that the truck's suspension system or steering controls probably were the reason the operator lost control of the truck. Other testimony by company employees revealed that the brakes had been working on the previous shift and that the rear brakes worked following the accident.

Lamonica Assumes Coal Deputy Post

Joseph Lamonica recently assumed duties as MSHA deputy administrator for coal mine safety and health. Lamonica, who is the first person to fill this position, previously was chief of MSHA's Division of Health, Coal Mine Safety and Health.

Lamonica joined the Bureau of Mines in 1963 as a physicist at the Respirator Testing Laboratory in Pittsburgh, Pa. From 1965 to 1972, he was with the bureau's respirable dust group. He also served as chief of the bureau's noise group before transferring to the Mining Enforcement and Safety Administration, MSHA's predecessor agency, in 1973.

REPORTS AND FILMS

Single copies of Informational Reports are available through:

MSHA, Office of Information
4015 Wilson Blvd., Rm. 1237-A
Ballston Tower No. 3
Arlington, Va. 22203

Films can be borrowed from the National Distribution Center in Pittsburgh, Pa. Send all requests to:

Motion Pictures
MSHA
4800 Forbes Ave.
Pittsburgh, Pa. 15213

Films can be purchased by directing requests to:

Chief, Division of Audio Visual Services
MSHA, Education and Training
4800 Forbes Ave.
Pittsburgh, Pa. 15213

Single copies of MSHA's Guide to Equipment Guarding are available through:

MSHA, Division of Safety
Metal and Nonmetal
4015 Wilson Blvd.
Arlington, Va. 22203

Safety Technolgy

Recent Additions to the MSHA Library

- **MSHA's Guide to Equipment Guarding, 1980,** 32 pp. 35 Figs.

This guide was developed by MSHA's metal and nonmetal mine safety and health enforcement personnel in order to set forth accepted principles for the guarding of moving machinery to prevent possible injury to miners. Specific examples of adequate guards for a variety of moving machine parts are illustrated.

- **Radiation Monitoring, 1979,** by R. L. Rock and Robert T. Beckman, 75 pp., 32 Figs.

This special report presents the outline of a course on mine radiation monitoring developed for MSHA inspection personnel and industry health and safety specialists. It includes concise information on the nature and history of radiation hazards in mining, current Federal and state radiation standards, techniques of measurement, keeping of exposure records, engineering controls and personal protective equipment. The report includes a glossary and bibliography.

Films

1. Illumination in Underground Coal Mines (Film No. 871)
2. Ground Control in Surface Coal Mining (Film No. 890)
3. Hazard Recognition and Avoidance in Surface Coal Mining (Film No. 891)

Stamp of Approval

The following equipment has been recently added to the Mine Safety and Health Administration's list of permissible or approved equipment.

- **Longwall mining system,** 950 volt, 3 phase, 60 hertz, alternating current, with (1) 500 hp, (3) 175 hp, (1) 125 hp, and (2) 75 hp, 950 volt, AC motors, issued to Dowty Corp., Zelienople, Pa.;
- **Model D-9 single arm roof drill with integral dust collecting system,** issued to Acme Machinery Co., Huntington, W.Va.;
- **Model Number SD-5890,** Type C, continuous flow class supplied-air respirator, issued to Standard Safety Equipment Co., Palatine, Ill.;
- **Conveyor Belt 441500,** issued to American Rubber Manufacturing Co., Oakland, Calif.;
- **Fire Resistant No. 410M Conveyor Belt.** issued to Bando Chemical Industries Ltd., Tokyo 104, Japan;
- **"ABC Vinolon FR Medium Heavy Duty" plastic brattice cloth,** issued to Peabody ABC Corp., Warsaw, Ind.;
- **"ABC Vinolon FR Air Check" plastic brattice cloth,** issued to Peabody ABC Corp., Warsaw, Ind.;
- **Atlas 7C,** issued to Atlas Powder Co., Tamaqua, Pa.
- **Model 21SC2A,** 250 volt, direct current, shuttle car with (2) 20/30 hp traction motors, (1) 12 hp conveyor motor, and (1) 13/20 hp pump motor, issued to Joy Manufacturing Co., Franklin, Pa.;
- **Model No. 101,** 6-volt, battery-powered, portable methane **detector,** issued to Appalachian Electronic Instruments Inc. Ronceverte, W.Va.;
- **Model No. MB-7,** 15-volt, battery-powered, Sonic Probe **Readout,** issued to Irad Gage Inc., Levanon, N.H.;
- **Model 10SC22C,** 440/550 volt, 3 phase, 60 hertz, alternating current, AC/DC shuttle car with (2) 250 volt, 35 hp, DC traction motors, (1) 30 hp, 440/550 VAC conveyor motor and (1) 15 hp, 440/550 VAC pump motor, issued to Joy Manufacturing Co., Franklin, Pa.;
- **Model D-9,** 250 volt, direct current, roof drill with integral dust collecting system with (1) 20 hp, 250 volt DC motor, issued to ACME Machinery Co., Huntington, W.Va.;
- **Model 21SC2B/21SCB,** 440/550 volt, 3 phase, 60 hertz, AC/DC shuttle car, with (2) 250 volt DC 30 hp, traction motors, (1) 25 hp, AC conveyor motor, and (1) 15 hp AC pump motor, issued to Joy Manufacturing Co., Franklin, Pa.;
- **Model Mini-Master Rockduster,** 96/128/250/550 volt, direct current, with (1) 5 hp, 96/128/250/550-volt D.C. motor, issued to Industrial Pneumatic Systems, Columbus, Ohio;
- **Model 18SC17A,** 440/550 volt, 3 phase, 60 hertz, AC/DC shuttle car, with (2) 20 hp, 250 VDC traction motors, (1) 25 hp, 440/550 VAC conveyor motor, and (1) 15 hp, 440/550 VAC pump motor, issued to Joy Manufacturing Co., Franklin, Pa.;
- **Longwall mining system,** 460/950 volts, 3 phase, 60 hertz, alternating current with (2) 230 hp, (2) 125 hp, and (2) 75 hp, 950 VAC, and (3) 75 hp, 460 VAC motors, issued to Mining Progress Inc., Charleston, W.Va.;
- **Longwall mining system,** 950 volt, 3 phase, 60 hertz, alternating current, with (1) 300 hp, (2) 150 hp, (2) 75 hp, and (1) 40 hp AC motors, issued to Dowty Corp., Zelienople, Pa.;
- **Longwall mining system,** 995 volt, 3 phase, 60 hertz, alternating current, with (2) 230 hp, (4 max.) 175 hp, and (2) 75 hap, 950 volt, AC motors, issued to Mining Progress Inc., Charleston, W.Va.;
- **Half mask respirators,** R4563, R5563, and R6563, issued to American Optical Corp., Southbridge, Mass.;
- **Full facepiece respirator R7563,** issued to American Optical Corp., Southbridge, Mass.;
- **Fire resistant conveyor belts mine Haul-OR-OS and/or Uniroyal Royalon Mine Haul-OR-PS and/or Uniroyal Royalon Gran For,** issued to Uniroyal Industrial Products, Port Clinton, Ohio;
- **Poly-VINYLAD Fire Resistant Conveyor Belt** PV400, PV500, PV600, PV700, PV800, issued to Unilok, Scottdale, Ga.;
- **Compound 07067,** to include use for cover of dust collector hose, issued to Gates Rubber Co., Denver, Colo.;

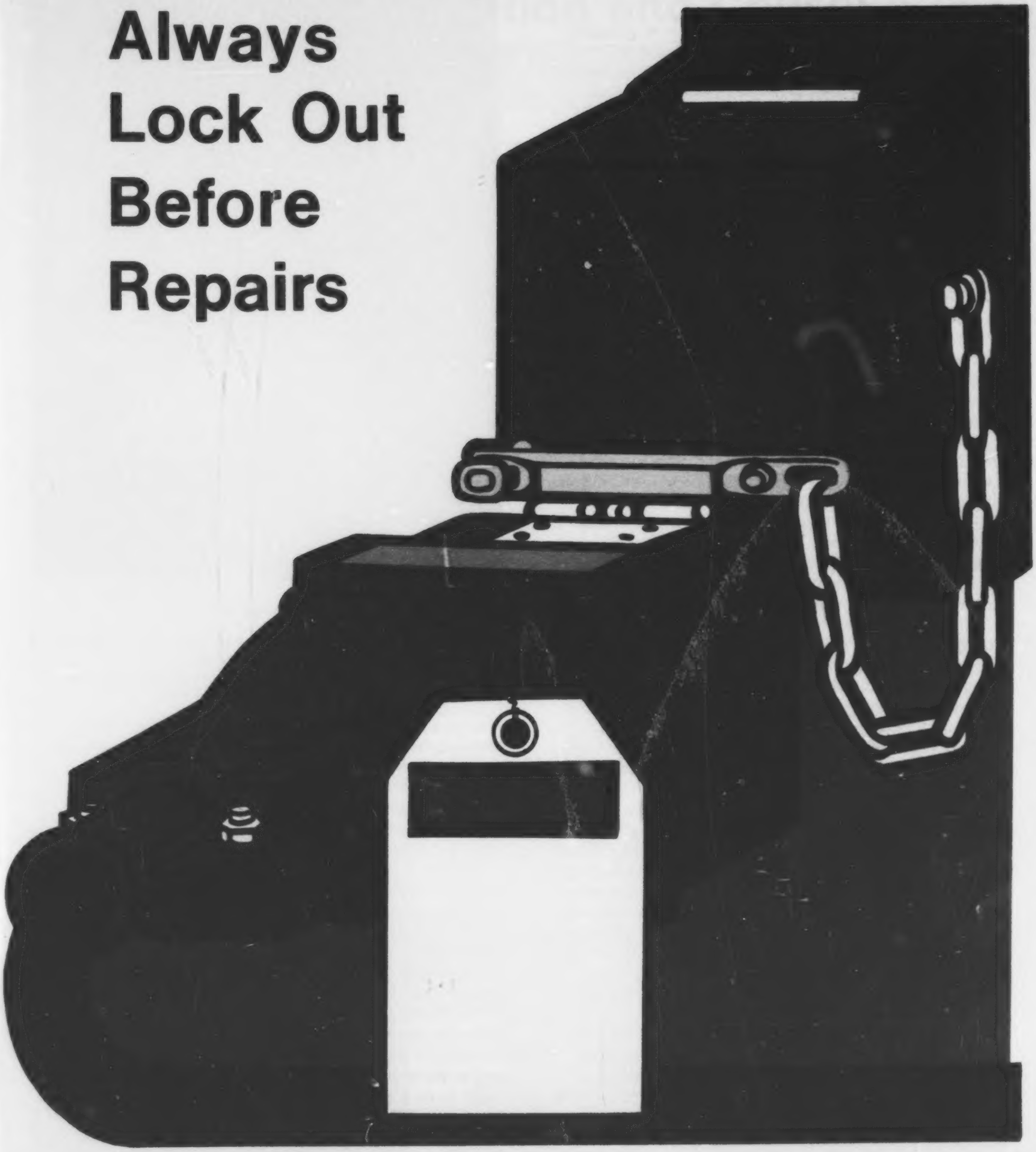
The poster on the opposite page is designed to encourage miners to observe and work toward improved safety practices. The poster, which was created by Art Director Columbus P. Knox, can be cut out of this issue and placed on bulletin boards or at other locations regularly passed by working miners.

Lumps 'N' Chunks

Drawn by C. P. Knox

... AND IF I EVER CATCH ANYONE OF YOU BUMS PULLING MISFIRED POWDER OUT OF A HOLE, I'LL FIRE YOU ON THE SPOT
MIKE, THEY SHOT A ROUND UP IN HIS LAST SHIFT, BAR DOWN, WET THE MUCK PILE, THEN GET IT MUCKED OUT, PRONTO!
NO SWEAT, BOSS I'LL GET IT ALL DONE BEFORE THE COFFEE BREAK.
ANOTHER ● MISFIRE, AND DON'T HAVE TIME TO SHOOT IT! WELL I'VE PULLED 'EM BEFORE, AND I GUESS IT'LL BE O.K. IF I BURY THIS ONE IN THE MUCK PILE!
YEH, J. D., SOME GUYS JUST NEVER SEEM TO LEARN!

Always Lock Out Before Repairs



Sherwood Mine

(Continued from Page 7)

Even so, the Sherwood Mine, like any mining operation, is not without its problems. "We get a lot of bees here each Spring," Meenach said, "and we have to check our employees annually to see if they have allergic reactions to the stings." And during that time of year, for reasons that are unclear to humans, crows in the area are known to boldly swoop down on haulage truck windshields in occasionally successful efforts to steal rubber wiper blades. The biggest seasonal problem, though, is the area's tough winters. In early 1979, temperatures dipped to 30 below zero. "The equipment runs belly deep in ice and snow, the drive trains take real hard abuse when tires slip, and often repairs have to be made right on the spot," said Larry Barnes, a maintenance training supervisor.

"Fortunately, we keep the warehouse well stocked with spare parts and we manage to keep most of the equipment in good shape through our regular maintenance program," he added. "Still, a mechanic out there wears a lot of bulky clothing, and sometimes it gets so cold that a wrench will damn near freeze to your fingers. We especially cover these hazards and others in safety meetings, and I think our people have been pretty careful about it." During the 1979 winter, one of the worst in years for the area, no Sherwood employees suffered a lost-time accident, proof, Barnes said, that the safety meetings have had a pronounced influence.

"I suppose one remarkable thing about their safety program is the speed in which it took effect," Alvin Fischer recently said. "Like any operation when it first starts up, they had some problems, most of them due, suppose, to the fact they had so many inexperienced people." Based on what appeared to be an inordinate number of minor accidents at Sherwood's mill in 1978, the operation was selected for MSHA's Program in Accident Reduction (PAR) for 1979. In March that year, MSHA investigators surveyed the safety program and audited the company's recordkeeping.

"By that time, the company had already reduced its injury rate, and it was obvious to us that its safety program was already doing an excellent job," said Fischer, one of the PAR investigators. Among others, the investigators found that the company had over-reported many injuries, mostly minor muscle strains, and that Meenach had mistakenly forgotten to include the hours mill maintenance employees worked with those worked by regular mill workers, an error that drove the mill's injury incidence rate much higher than it actually was. Meenach was not upset, however.

"I figured when the PAR people came out to the mine, it would give me a good chance to get a good working relationship going with the inspectors," Meenach said. "They did point out some areas I had overlooked . . . and they found, for instance, that we had some problems of communication between hourly employees and a particular supervisor, a matter we quickly cleared up. It's really just the kind of help many safety departments can use, and in ways it reminds me of when MSHA was MESA."

When Sherwood Mine was removed from the PAR program in January 1980, Meenach protested. Larry Nelson, a MSHA inspector supervisor in Couer d'Alene, Idaho, recently remembered the phone call. "George was upset that we wanted to leave him alone," he said. "He told me that the employees enjoyed the attention and were glad that we had the time to come out and care about the operation. Frankly, I was surprised to see he was so insistent that we come back."

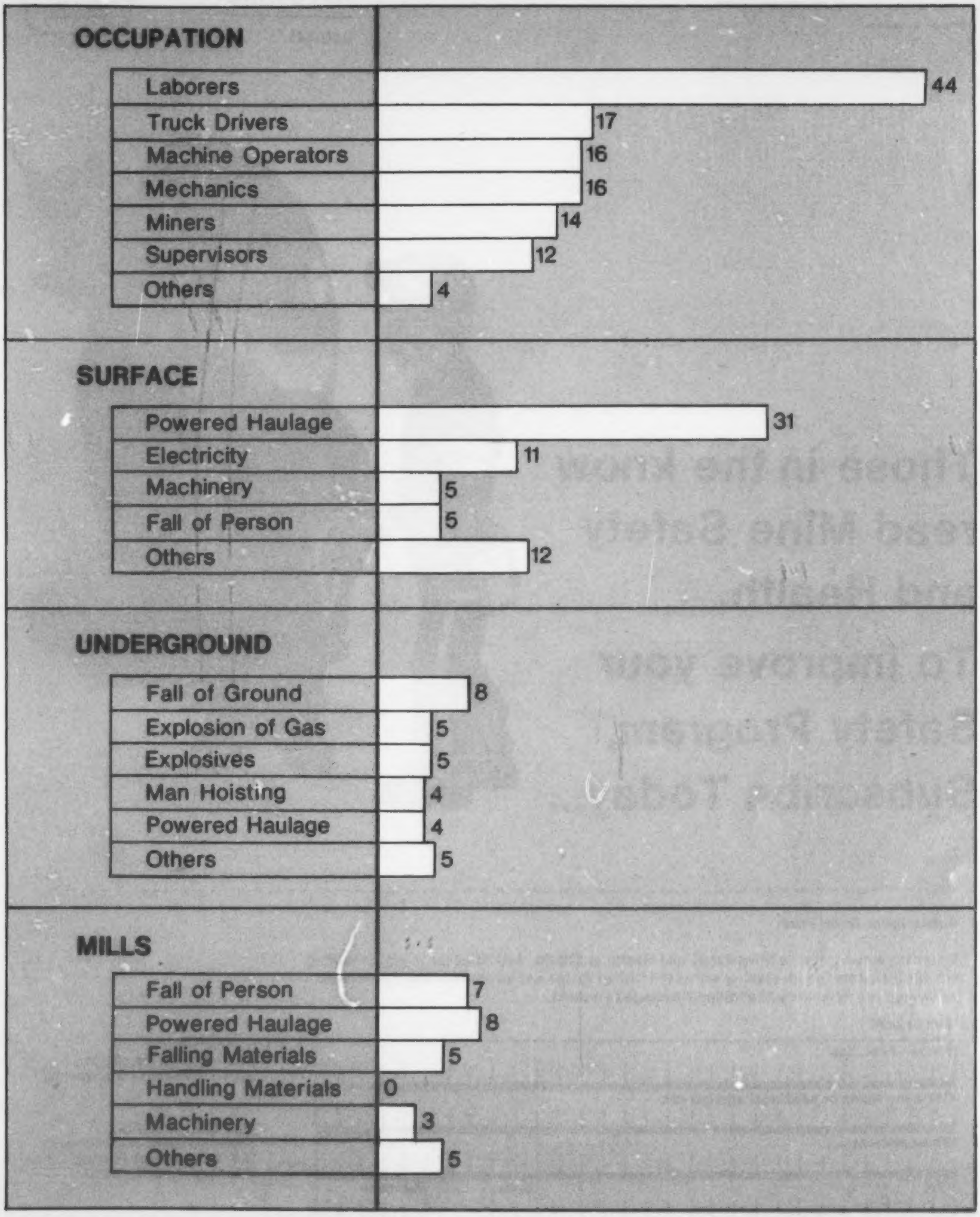
A rubber "boat muffler", at right, clamped onto the exhaust port of an Ingersoll-Rand drill machine has been effective in reducing noise exposure levels for 116 dBA to as low as 104 dBA as measured during use at the Sherwood Mine. Ray Davis, the mine's drilling and blasting foreman, first discovered this particular type of muffler at a Valdes, Alaska, marina when he worked on the Alaskan oil pipeline project in 1973.

The PAR investigators now visit the mine on a quarterly basis on so-called follow-up investigations, even though the mine's accident experience is low and regular inspections of the facility have revealed few violations.

"I've never really understood why some people want to fight MSHA," Meenach said. "I guess it can be traced to how many operators feel about the 1977 Act. MSHA really did need more teeth, I think, and they needed the authority to fine for violations in this type of mining. My only gripe is that if a violation is found, the company ought to be given a chance to fix it on the spot, not be fined right off.

"I suppose there might be a few hard-liners out there who don't want MSHA poking around, but I think my company realized a long time ago that every little bit of help pays off. Aside from the fact that it benefits the company economically, it helps fulfill a strong moral obligation we all should have."

Metal/Nonmetal Fatalities for 1979 by Occupation, Location and Cause:



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Mine Safety & Health

U.S. Department of Labor
Mine Safety and Health
Administration

July - August

The Belle Isle Explosion--P. 2
New Life for an Old Mine--P. 8

L 38.9:

What They're Saying . . .

"At age 23, the miner had 5½ years of mining experience, and he was on his way up . . . But a rock that was six feet square by eight inches thick fell from the mine roof . . . The miner died about four hours later . . . Setting the proper number of (temporary roof supports) was his job, and his failure to set them properly contributed to his death, the report concluded."

—From an article on Kentucky mining fatalities in the Louisville Courier-Journal.

"We need to encourage the men that (coal dust) sampling is for their benefit. When men sampled don't know how to get the results of samples, it hurts. They should be entitled to a copy of the report on the samples taken."

—Ed Noble, a United Mine Workers of America member, testifying at a public hearing on proposed changes in MSHA's respirable dust regulations.

"Coal miners are the only ones who really know what dust is . . . a dust sampler doesn't breathe. A coal miner does and he breathes hard. Dust goes deep into his lungs. The sampler doesn't work like that . . ."

—Martin Amburgy, West Virginia Black Lung Assn., also testifying on proposed changes in the coal dust regulations.

". . . C. T. Shaw, associate professor of the Department of Mining and Minerals Engineering, Virginia Polytechnic Institute and State University, . . . noted that safety in mines is dependent on three factors: the mining environment, clearly assigned responsibility, and safety legislation . . . Mine design, mining methods and technology development are required to reduce the likelihood of accidents caused by conditions . . . Shaw went on to state, however, that a crucial factor . . . is the acceptance of (management's) responsibility . . . for encouraging a commitment to safety by its supervisors and miners . . . Lastly, a safety enforcement program must be directed at ensuring a safe environment while holding accountable those responsible for unsafe acts . . ."

—Mining Congress Journal, from a report on proceedings at the American Mining Congress International Coal Show.

"Never forget that you are women. Whenever a man goes into the mines, no one expects him to give up his manhood, and don't you give up your femininity just because you become a miner."

—Dennis Saunders, president of Local 29, United Mine Workers of America, addressing the National Women Miners' Conference at the National Mine Health and Safety Academy, Beckley, W.Va.

Mine Safety & Health

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July - August

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Cover
A lizard suns itself near the portal of the Sutro Tunnel, a long drainage drift completed in 1878 to service the West's famous Comstock Lode mines. The area is experiencing renewed activity due to rises in precious metals prices. (See article on Page 8.) The photo was taken by Ralph Lewis.
Inside front cover
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2 **The Belle Isle Explosion**
8 **Reopening Old Mines Presents Both Opportunities and Problems**
14 **Union Safety Concern: an Interview With UMWA President Sam Church**
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19 **Update Section . . . New standards and technology, legal decisions, recent publications, meetings, safety cartoon**
Inside back cover
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July/August 1980 issue, Volume 5, No. 4

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United States Department of Labor

Robert B. Lagather, Assistant Secretary
Mine Safety and Health

Wayne E. Veneman, Chief
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Samuel A. Stafford, Editor, Mine Safety and Health Magazine; Ralph E. Lewis, Assistant Editor; Columbus P. Knox, Art Director; Fred Biglo, Graphics Consultant; Sharon Maines, Editorial Clerk. Photos with article on the Belle Isle Salt Mine explosion by Earl Mazzeo, MSHA Audio Visual Office; Photos with article on reopening of the New Savage Mine by Ralph Lewis and courtesy of the National Archives and the Special Collections Department of the Unversity of Nevada Library; Photos with article on State Inspector of Mines William Dubois courtesy of the Nevada Industrial Commission; Photo of United Mine Workers of America President Sam Church, Jr. by Ralph Lewis.

Investigators who entered the Belle Isle Salt Mine following the June 1979 explosion in which five miners died found grim evidence of the unbelievable destructive forces unleashed in widely scattered mine areas. Shown above is what was left of a shop truck that had been used by two shot-firers who died in the explosion.

The Belle Isle EXPLOSION

Friday, June 8, 1979 .....

The first muffled explosion was heard just before 11 p.m., near shift's end on Friday, June 8, 1979. Because it was a scheduled blast, A. J. Boutte, the Belle Isle Salt Mine's shift foreman, gave it little thought as he proceeded to his regular meeting with production crew members.

The second, larger explosion came 10 minutes later as the meeting was breaking up, sending a tremendous shock wave through the lower level drifts, ripping through the tunnel and knocking Boutte and his crew to the floor. The blast was immediately followed by intensely hot wind of near hurricane force.

At that moment in 1 Main Entry South, Herman Zimmerman, the plant maintenance master, was riding in a jeep driven by miner Jason Mayon. When the concussive wave struck the jeep, it spun out of control and careened to rest with the rear wheels hanging over the edge of a conveyor decline. Zimmerman died instantly when he was thrown 30 feet to the floor of the decline. Jason Mayon, confused and disoriented, suffered back injuries as he fell onto the conveyor after climbing out of the jeep . . .

Richard Collins, Donald Mayon and Peggy Blaney had been sitting in a vehicle next to the No. 1 shaft station awaiting the end of the shift. The awesome blast blew their vehicle from the shaft area into 2 Main Entry South. Collins and Donald Mayon died in seconds of acute lung damage and asphyxiation. Blaney, terrified and in agony due to second and third-degree flash burns and severe bruises, struggled free of the wreckage and made her way through the windy passageway toward what she hoped would be safety . . .

Two men were riding in this jeep in the Belle Isle Salt Mine's 1 Main Entry South when the tremendous shock wave struck them. Plant maintenance master Herman Zimmerman was killed when he was thrown from the vehicle and fell 30 feet to the floor of a conveyor decline after the jeep spun out of control and came to rest overhanging the cut.

Miners Adam Sampay and Amedee Olivier, both in their twenties, had initiated the first, scheduled blast shortly before 11 p.m., detonating three charged rounds from the blasting board at 7 Main Entry East. The routine blast, MSHA investigators later concluded, set the stage for the massive second explosion. During the 10 minutes they lived before the torrid airblast struck and killed them, Sampay and Olivier traveled more than half a mile, taking separate routes, to the mine areas where their bodies were eventually found. Olivier's death was attributed to carbon monoxide poisoning and ruptured lung tissue. Sampay's death was caused by acute lung damage. Both victims had suffered multiple flash burns.

The initial shock wave and the incredibly high winds that followed blew out all stoppings and doors in the crosscuts off the 1 and 2 Main Entries South and the air was short-circuited from No. 2 shaft to No. 1 shaft. The gale destroyed fans and other ventilation controls, propelled some miners many feet from where they had originally been sitting or standing, upended heavy mobile equipment and tossed it about as though it weighed a few ounces, and, in addition to the fatal injuries, caused broken bones, ruptured eardrums, heat-seared lungs and cuts and bruises.

Shift foreman A. J. Boutte, one of 17 survivors of the disaster at Cargill, Inc.'s Belle Isle Mine near Franklin, St. Mary Parish, La., later recalled that he had been unable to think clearly as he tried to find his way out of the mine after the explosion, that he frequently stumbled and fell, bumped into objects in the travelway and was blown from side to side by the salt-laden gale.

Seconds after the full force of the explosion struck the area where the production meeting had been held at the bottom of the lower level manlift off 1 Main Tunnel South, visibility was reduced to near zero by swirling dust, debris and salt in the air.

Concussion, Searing Wind Storm Killed 5 Miners in Seconds

Groping blindly, Boutte moved toward the airway tunnel, the fresh air source for the lower level and designated escapeway. But he found the wind in the tunnel even hotter and more violent, and, as he stepped inside was hurled 30 feet along the passageway.

Stunned, Boutte crawled back to the culverts where he had first entered the tunnel and proceeded into the main drift. Although wind and heat conditions were more bearable there, visibility was still poor. Boutte then stumbled slowly up the inclined travelway that lead to No. 1 shaft station on the upper level. There, he and five other survivors were able to splice together parts from two explosion-damaged telephones and call for help.

A badly damaged Gradall scaler is examined by a team investigating the 1979 explosion at the Belle Isle Mine in Louisiana. Because heat from the blast was less intense in this area of the mine than some others, paint on the scaler showed less deterioration than painted surfaces did in some other locations.

General Mine Foreman Elray Granger, who was on the surface at the time of the explosion, said later that the sound of the explosion had been heard faintly at first, then had grown progressively louder until the noise coming out of both the No. 1 and No. 2 shafts along with dust, smoke and debris was comparable to that made by half a dozen freight trains.

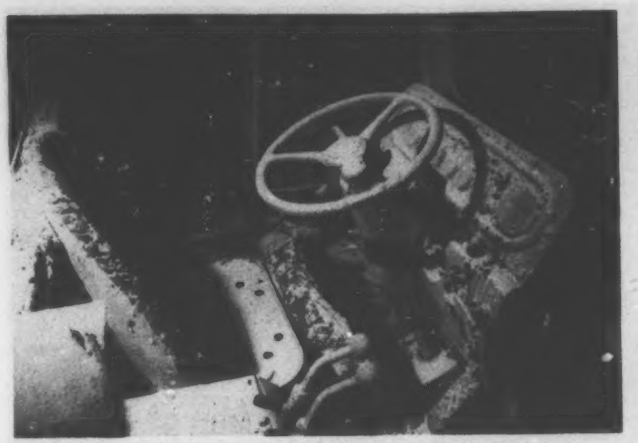
> *The initial shock wave and the incredibly high winds . . . propelled some miners many feet from where they had been sitting or standing . . . A. J. Boutte recalled that he frequently stumbled and fell, bumped into objects in the travelway and was blown from side to side by the salt-laden gale . . .*

Granger had been underground throughout the shift, but had returned to the surface at about 11 p.m.

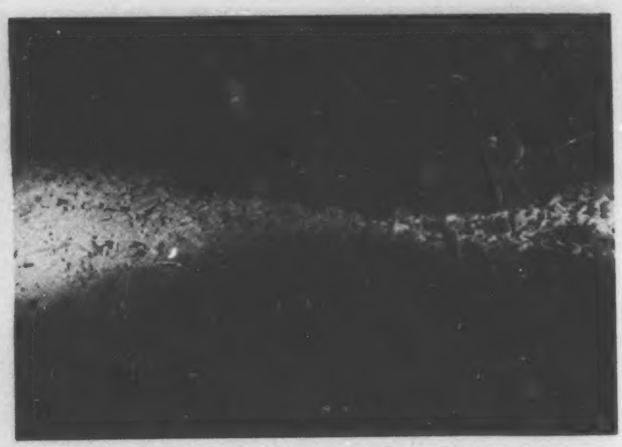
Finding the mancage a few feet above the No. 1 shaft collar and debris and loose cables piled around the collar area, Granger and topside foreman Terry Herbert began cleaning up the area before sending the cage down to the mine level with a communications radio aboard.

As they did so, the phone rang. Below, A. J. Boutte

At the time the explosive wave and gale-force winds struck, 12 Belle Isle Mine employees were at the site. Despite searing heat and choking airborne dust in the escapeway, all managed to make their way to safety.



Heat damage in the cab of a Terex loader in the mine's lower level. Vinyl seatcovering was burned off in the sudden flash, leaving the heavily scorched foam padding exposed.



Investigators look over tons of salt piled in a mine room as a result of an "outburst" of flammable gases under high pressure and salt which was triggered by production blasting. An estimated 15,750 tons of broken salt were expelled in the blowout. A methane explosion which occurred about 10 minutes after the outburst killed five miners and caused widespread damage.

explained the situation to Granger, rang off, then called again to urge those on the surface to send the cage down quickly because he could see "the bad air coming." Ten minutes later, Boutte and the five other survivors, Eldridge Roman, Peter Boutte, Perry Thompson, Jason Mayon and Peggy Blaney were hoisted to the surface.

At about 12:45 a.m., on Sunday, June 9, Clyde McKay, a shaft hoistman, heard pounding signals from the bottom of the No. 2 shaft.

> *. . . On the surface . . . , the sound of the explosion had been heard faintly at first, then had grown progressively louder until the noise coming out of both the No. 1 and No. 2 shafts along with dust, smoke and debris was comparable to that made by half a dozen freight trains . . .*

The signals, as it turned out, were being made by some of the 11 miners who had been at the lower level production meeting just before the blast.

In the confusion following the explosion, miner Floyd Linton had followed A. J. Boutte to the corrugated culvert, but had not continued with Boutte to 2 Main Tunnel South, returning instead to the other 10 miners at the manlift.

Linton, a Cargill mine rescue team member, then suggested the group join hands and try to use the escape route to the No. 2 shaft.

Moving slowly through 1 Main Tunnel South, the 11 men were subjected to intense heat and choking dust. Because the main fan had been destroyed, the air movement at the No. 2 shaft appeared to have reversed from intake to exhaust, making it difficult for the miners to breathe.

After hearing the signals made by pipe being banged against the No. 2 shaft station gate far below, McKay and others began efforts to clear the mancage which the concussion had lodged in the upper part of the headframe. Several tries were necessary before the conveyance could clear all of the obstructions in the shaft. The 11 survivors were hoisted to safety at 2:45 a.m. Except for one man, Alton Oppenheimer, who had suffered a side injury in the initial concussion, the weary, badly shaken miners were unhurt.

MSHA investigators determined that the routine scheduled blast had been initiated by shot-firers Adam Sampay and Amedee Olivier in the Belle Isle Mine's 7 Main Entry East between rooms 12 and 13, and that a massive "outburst" of flammable gases and salt had been triggered by the blast.

Such outbursts of high-pressure gases and salt out of large vertical "pressure pockets" have been documented in the Belle Isle and neighboring salt mines for many years. Sizeable outbursts have occurred when salt with high-pressure gases contained in rock structure has been penetrated by mine openings.

In the Belle Isle outburst, an estimated 350,000 cubic feet of broken salt, or about 15,750 tons, were expelled.

The two shot-firers, believed to have been severely shaken but not seriously injured by the outburst, abandoned their shop truck, which was later found overturned, and started toward the shaft.

> *. . . Moving slowly through 1 Main Tunnel South, the 11 men were subjected to intense heat and choking dust. Because the main fan had been destroyed, the air movement at the No. 2 shaft appeared to have reversed from intake to exhaust, making it difficult for the miners to breathe.*

The cart shown overturned at right was occupied by three miners when it was blown from a point near the No. 1 shaft into 2 Main Entry South by the shock wave created by the explosion. Two died of acute lung damage and asphyxiation. The third suffered burns and bruises, but survived.

According to the MSHA investigators' report, gases released encompassed an estimated volume of about four million cubic feet within 500 feet of the blowout cavity. It is believed that the rapid expulsion of methane created too high a concentration to be ignited immediately in the face area, but that as the methane increasingly was diluted by air at the fringes of the gassy zone, the mixture reached the explosive range.

The explosion occurred 10 minutes after the outburst, according to the report, when the expansion process caused explosive methane-air mixtures to migrate to an area containing electric sparks, arcs or burning electrical cable insulation which ignited the flammable gases.

Sampay and Olivier were killed as they traveled toward the shaft when they were struck by the tremendous pressure wave created by the gas explosion.

The heat generated by the explosion was most intense on the upper level of the mine. The blistering flash that accompanied the shock wave reached temperatures estimated at up to 900 degrees Fahrenheit in a number of areas. Temperatures of more than 2,000 degrees may be attained in a methane-air explosion at specific locations, and combustible solid materials show flash ignition at such temperatures. Within the explosion zone, investigators later determined, flame had been present at most locations in the upper level headings. The flash had caused burns to some victims and had charred and melted materials in its path.

Electrical power distribution cable and all other mining equipment in the upper level headings and rooms within 500 feet of the blowout cavity suffered severe heat

An underground maintenance office was left a pile of rubble by the concussive force of the explosion and accompanying windstorm.

The heat generated by the explosion was most intense on the upper level of the mine. The blistering flash that accompanied the shock wave reached temperatures estimated at up to 999 degrees Fahrenheit in a number of areas . . . the flash had caused burns to some victims and had charred and melted materials in its path.

damage. Power cable that was not covered by salt was deeply charred or burned away. Plastic material, tires and hydraulic hoses showed extensive heat deterioration. Exposed paint was badly scorched.

The high-temperature gases and hot air whipped through the air tunnels in the immediate wake of the concussive pressure wave which completely destroyed a core drill and twisted other mobile equipment out of shape, shattered underground structures like an office and parts room, and left wiring in spaghetti-like tangles.

Even as the 17 survivors were being checked for injuries and treated at nearby Franklin Memorial Hospital in the early hours of Saturday, June 9, mine rescue teams from Cargill, Inc., the International Salt Co., the Morton Salt Co., the Diamond Crystal Salt Co., and personnel from MSHA's Metal and Nonmetal National Mine Rescue Team were on the scene or being mobilized to aid in the attempt to quickly reach the five missing men.

Supervisory mining engineer Jay Durfee of MSHA's Baton Rouge office arrived with mine inspector Jerry Millard at 3:15 a.m.

At 5:55 a.m. the Cargill No. 1 rescue team entered the mine through the No. 2 shaft, and moving with extreme caution, checked conditions underground. Returning to the surface 35 minutes later, the team reported a methane concentration of 1.0 percent about 180 feet of the No. 1 shaft station. The Cargill No. 1 team re-entered the mine shortly after 8 a.m., and during the next hour and a half located the bodies of Donald Mayon, Collins and Zimmerman. At 11 a.m., two International Salt Co. rescue teams went underground, each accompanied by a Cargill team member and returned to the surface at about 1 a.m. with word that they had located the body of shot-firer Amedee Olivier.Bodies of the four victims were recovered and brought to the surface through the No. 1 shaft by rescue teams composed of personnel from MSHA, Cargill and the Diamond Crystal Salt Co.

Throughout Saturday afternoon and evening, MSHA and salt company teams searched unsuccessfully for the last missing miner, shot-firer Adam Sampay.

With the arrival of more rescue personnel and equipment Saturday night and early Sunday, MSHA and company officials were able to map out a systematic plan for locating the missing miner using the combined manpower and resources now available. The explosion had blown out the underground main fan and many stoppings and doors. To improve ventilation in areas to be explored, a fan borrowed from the Department of Energy was installed at the collar of the No. 2 shaft, providing fresh air and increasing exhaust air volume fourfold.

The high-temperature gases and hot air whipped through the air tunnels in the immediate wake of the concussive pressure wave which completely destroyed a core drill and twisted other mobile equipment out of shape, shattered underground structures like an office and parts room and left wiring in spaghetti-like tangles.

(Continued on Page 28)

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Mules haul ore wagons from loading chutes of the old Savage Mine in this 1867 photograph. The scene is among several surface and underground views of Comstock Lode gold and silver mines taken by Timothy O'Sullivan, a well-known photographer of the American West during the late 1860s.

Pace of Gold and Silver Search Quickens

Reopening of Old Mines Presents Both Opportunities and Problems

By Ralph Lewis
Assistant Editor, Mine Safety and Health

> *"After meditating on the paths, lanes, alleys, roads, crossroads, and highways of the great group of mines, rising by stairs on stairs, from level to level, one is ready to grasp the completed conception of the labyrinthian wilderness, where, in the midst of abandoned acres of caves, pitfalls, and jungles of fungi-overgrown timbers, lie masses of ore and yet undiscovered bonanzas . . ."*—
> Charles Howard Shinn, 1896.

It made millions for a handful of ordinary men, launched the careers of Mark Twain and George Hearst, and, some say, financed the Victorian splendor of early San Francisco. It also destroyed vast family fortunes, bred a new generation of broken-hearted alcoholics, and left hundreds dead and thousands more crippled for life.

Named after an itinerant prospector who had little to do with its discovery in 1859, Nevada's great Comstock Lode eventually yielded an estimated eight million ounces of gold and 100 million ounces of silver—about $6.5 billion by today's inflationary dollars. She did not give up her riches easily, though. The massive pockets of rich silver ore, shrouded for eons by water-soaked clay seams and brittle quartz, simply defied the time-tested mining methods that had been used during the California Gold Rush ten years before. In fact, the unique conditions of the Comstock required an almost miraculous metamorphosis of the existing hardrock technology—bringing forth new methods and equipment that in principle, have remained basically unchanged to this day.

With the phenomenal increase in silver and gold prices in recent years, small mine owners have now reopened hundreds of abandoned "dog-hole" operations throughout the West. Not surprisingly, interest in the Comstock has also been brisk. In 1977, Houston Oil and Minerals Corporation reopened the old Con-Imperial mine pit on Gold Hill, and built a new American Flat mill nearby. Two years later, the United Mining Corporation, a smaller company, broke ground on the site of the old Savage Mine in Virginia City, launching an underground operation which will eventually extend through most major portions of the lode.

From a health and safety viewpoint, the modern-day mining efforts involve hazards not too dissimilar from those faced by hardrock hands a hundred years ago. The ground conditions can still be capricious. The timbers used today are still capable of burning. But thanks, in part, to the technology that evolved from the experiences of their predecessors, today's Comstock miners face far fewer risks.

Those developments eliminated many hazards of the old methods while creating a whole set of new ones. The first among them was the "square-set" method of timbering. When underground mining first began at the Ophir Mine in 1860, any hopes for instant wealth were almost buried when cave-ins killed several miners and frightened away many more. In near desperation, owners of the Ophir finally called in young Philip Deidesheimer, a German engineer who had developed a worthy reputation in the California goldfields. After working quietly for several weeks, he developed a series of interlocking, 14-by-14 inch beams that could be constructed like a puzzle into a framework capable of supporting the massive, open stopes of the huge "bonanza" pockets. Ironically, as an historical footnote, the method was never patented and Deidesheimer later lost his personal savings in unwise Comstock stock speculation years later.

> *From a health and safety viewpoint, the modern-day mining efforts involve hazards not too dissimilar from those faced by hardrock hands a hundred years ago. The ground conditions can still be capricious. The timbers used today are still capable of burning. But thanks in part to technology that evolved from experiences of their predecessors, today's Comstock miners face far fewer risks...*

Other developments responded to different problems of 19th century mining as operations were deepened. A. S. Hallidie, inventor of San Francisco's cable car system, developed a flat-woven wire hoisting rope to replace the stretching strands of hemp that had been used before. Alfred Nobel's dynamite, the Leyner and Burleigh air drills, and giant steam-powered pumping and ventilation systems soon followed, and by the mid-1870's, Comstock miners had improved ground support over their felt-hat covered heads, a stronger hoisting rope, and less fetid air to breathe.

Located on the site of its namesake that operated more than a century ago, the New Savage Mine in Virginia City, Nev., is expected to produce as much as 10 million tons of low-grade silver and gold ore during its lifetime. Recent price rises for precious metals have made it feasible to reopen hundreds of abandoned mines throughout the West.

As often happens, however, the advances in mining methods were accompanied by new dangers. Torched by a candle, Deidesheimer's "square-sets" could roar into a raging Hades in seconds. In 1869, more than 45 miners died when an early morning fire swept through the Crown Point Mine and two adjacent workings. In other incidents, many were killed when the soft seams of clay soaked with water and exposed to man-made voids, squeezed against the timbers and collapsed whole drifts. Though hoisting rope was much stronger than before, hoisting speeds also had increased and cages were nothing more than crude iron frames which offered little protection to their occupants. Many a leg, arm or head carelessly poked from the confines of a swiftly moving cage were violently torn off by the unforgiving shaft timbers outside. Premature explosions and the stifling heat and scalding water of the

Miner Charlie Marrujo drills out the face of a new mine heading under the protection of nine-by-nine-foot timber sets at the reopened New Savage Mine. Today's miners, though much better equipped than their counterparts more than a century ago, face similar difficult ground conditions. Evidence of this is the "hung" drill steel shown in the upper corner of the photo which became tightly wedged in a collapsed hole during the present operation.

deeper workings caused many more deaths and injuries, and many of those who managed to survive all this were disabled by the silica-laden clouds of lung-damaging rock dust generated by the new-fangled "widow-maker" air drills.

When the big bonanzas began to play out, the Comstock itself began to die in the late 1870's. Twenty years later, the marvelous underground cities had decayed into musty chambers of rotting Sierra spruce. Since then, a few mining companies have returned in efforts to squeeze a little bit more out of the once great plum, but if, in fact, an undiscovered bonanza was overlooked by the old-timers, it has, to this day, remained as elusive as triple "jackpot sevens" on a one-armed bandit.

Tim Collins, 40, is apparently willing to take the gamble once more. A native Coloradan who became involved with investment banking in New York City in the late 1960's, he is convinced the Comstock will pay big again. In 1978, he began laying the groundwork for a new mining project with the hopes of recovering low-grade gold and silver ore from the chain of mines that once comprised the main body of the famous lode.

At the time, Houston Oil and Minerals held several leases and had done extensive exploration work in the old New York Mine while even rebuilding a portion of the Sutro tunnel, a drainage drift built in 1878 to service the deep Comstock workings. Apparently more interested in the economics of developing its surface mine on nearby Gold Hill, Houston decided to abandon their underground projects. Collins obtained financial backing for the United Mining Corp., and obtained the other existing leases from three small mining companies and a Virginia City resident.

"When I first started putting this thing together, I believed three things," Collins said. "First, you have extremely wide veins on the lode, some ranging from 20 to 200 feet. Secondly, I believed that the drainage previously established along the lode was intact and rock conditions would be better than in the old days. Finally, I was convinced the price of silver would rise. The fact that gold and silver went up so fast was really an unexpected bonus."

The real bonus, however, is what Collins said is a "reasonably good chance" of hitting a piece of the fabulously rich "Big Bonanza", discovered in 1873 on the 1,200-foot level of the old Consolidated Virginia mine. The last and biggest strike on the Comstock, this pocket of ore contained roughly 650,000 cubic yards of ore so rich that the silver occurred in nearly pure clumps and wire-like bands in some places. Though it was finally mined out by the early 1880's, a small chunk of it remains untouched, Collins believes. "In 1977, core drilling pretty well confirmed the theory that a top portion of the Big Bonanza was displayed by geological faulting after the area was formed," he said. "I guess it's up to us to prove that theory and get the ore out safely as well."

After considerable geological and historical research, crew members of United Mining's New Savage Mine pushed their first shovel of muck in May 1979. Since then, two crews of four miners each working two shifts a day have driven over 2,000 feet of decline at a 13 percent grade to a point about 400 feet below Virginia City's famous C Street. In June 1979, they hit the Comstock orebody, and recently they began drifting the first two of a series of crosscuts which will be cut across the main lode at 100-foot intervals.

Once a few of these cuts are completed, crews will begin to stope up into the lode, eventually extracting the ore by means of the horizontal cut and fill method. A possibility exists that Deidesheimer's "square sets" may be used in the stopes, said Bob Peck, the company's chief engineer, but any similarity to the old methods will probably stop there. Like many of the other old mines that are reopening in the West, the New Savage will avoid a shaft haulage system in favor of diesel-powered rubber tire equipment. Currently, crews haul muck from the face with a Wagner ST-2 loader, dumping dippers into a 10-ton Elmac truck for haulage up the decline.

"Looking at the old days, our haulage system marks the biggest contrast," said mine manager Earl Haldeman. "Back then, they were lucky to get out about a ton per man. We can get anywhere from 10 to 20 tons," he said.

Late this year, United Mining plans to sink a 450-foot ventilation and escape shaft, one that could possibly be enlarged someday to accommodate skip hoisting. Collins estimates that at least 10 million tons may be available for recovery, and optimistically predicts that the life of the mine may extend as long as 30 or 40 years, about ten years longer than the first big boom a hundred years ago. "There are just a lot of blank zones down there they missed years ago," he said.

Unlike its namesake, the New Savage Mine, equipped with modern machinery, is far less hazardous to those who have inherited the job of recovering those riches yet to be found. In contrast to the several fatalities that occurred at the Ophir Mine during its early years, the New Savage suffered only one relatively minor lost-time accident in its first year of operation. Still, the modern-day miners have had to cope with some of the same tough ground conditions. The six-foot rounds are drilled with conventional jacklegs, and though punching through the coarse ground is sometimes akin to poking a hot welding rod through 90-weight grease, the rotten rock often refuses to let the steel go. About 90 percent of all drifts are supported by nine-by-nine foot timber sets—tinder for massive fires years ago, but a hazard that has been diminished over the years with the introduction of modern fire fighting equipment and mine emergency training.

The New Savage Mine is being developed along the chain of mines that once made up a major part of the Comstock Lode. Above, day shift lead miner Charlie Marrujo poses proudly near the blackened timbers of a drift believed to have been driven with hand steel from the old Hale and Norcross Mine shaft in the late 1860s.

Hewn from expensive Oregon fir, these 10-by-10 inch timbers were put to the test when crews first ran into some clay seams about 480 feet down the decline. For about 150 feet, they spiled through the water-soaked area, and since then, a number of caps—the top cross-members—which were splintered by the high pressure of the squeezing ribs, have had to be replaced. Spiling in this case consists of a series of interlocking steel channel-iron rails which, driven over the cap ahead of the timber set, affords protection to miners from the top or "back" of the drift past the last set. In recent months, water from the clay seams has eased off considerably, perhaps due in part to the efforts of an ingenious cigar maker a century before.

His name was Adolf Sutro, and in the late 1860's, he launched a project that was considered a main engineering feat of the day. Through a combination of luck, guts and determination, Sutro managed the construction of a nearly four-mile long tunnel to the central body of the Comstock Lode.

> *Digging through library files, mine personnel obtained a wealth of old mining maps, and now the Savage crews have a pretty fair idea of what lies ahead. It's a strange feeling going in there with a lot of the information the old-timers never had, "a company official said, noting, however, that much is unknown about exact mining methods during the 19th Century, and that, "in that sense, ours is really a pioneering effort."*

Originally, the tunnel was to serve the dual purpose of a haulageway to a mill at the portal and as a drainage drift for the high volumes of water which had plagued the deeper workings along the lode. Mill owners were bitterly opposed to the idea, mine operators despised the thought of being surcharged per ton of ore, and the lack of capital backing eventually delayed completion of the engineering wonder until 1878, almost too late for the tunnel to do any good. Fortunately for him, Sutro sold his shares of the tunnel company early in the game and beat a hasty retreat to San Francisco where he later became a popular mayor.

A financial disaster to the remaining shareholders, the Sutro today appears to be a boon for the New Savage owners. It just so happens that the tunnel connects the old Savage mine right at the 1,650-foot level, not far below the new workings. Collins estimates that the orebody may be dry up to the 800-foot level, possibly as far down as the original intersection. "Mix water with this rotten rock, and you get oatmeal," Collins said. "Thanks to Sutro, we can say our ground conditions here will be much safer than it was for the old-time hardrockers." In addition, the

The remains of an old candle, shown in the right hand, and its holder were found by present-day miners when they broke into an abandoned drift driven more than a century ago at a location about 1,000 feet from the portal of today's New Savage Mine.

thinking goes, the Sutro still probably provides a little bit of natural ventilation to some of the old workings, reducing the chances that New Savage miners will run into carbon dioxide as they drift through those areas.

In January 1980, a New Savage crew had their first brush with history when, 980 feet from the portal, they broke into an old drift. "The boys were drilling on a night shift when they noticed they were losing water in a hole on the left rib," recalled Earl Haldeman. "After they shot the round, I went down to take a look and monitor for gas. The bottom of the drift was only about two feet above ours, and you could see back in there about 15 feet," he added. "I'll tell you, it was really like looking into a whole new world."

Fortunately, no carbon dioxide was detected. But miners did discover what was left of two old candles and a piece of the original candle holder. The five-by-seven foot drift, still supported to a degree by water-darkened timbers and hand-hewed wedges, was a mystery to Bob Peck, who could not find it on any of the old maps. "I did some further digging into the records and finally found a map which indicated it had been driven from the old Hale and Norcross shaft on the 437-foot level sometime between 1868 and 1890." Because of the candles, Haldeman believes the drift was probably driven with hand steel in the late 1860's.

Following the drift for about 200 feet, Savage miners also ran into a couple of small raises. One of the raises contained a small amount of extraordinarily high-grade ore, but scattered throughout both were tiny wood splinters, evidence that the old mine had once been inundated with a great rush of water.

As a precautionary measure, the Savage crews drill a 20-foot test hole in advance of the face in wet areas to check for possible underground reservoirs between clay seams or in abandoned workings. The biggest threat from mined-out areas is the chance they might contain trapped volumes of carbon dioxide. While it might be a problem for some small mine operators working in old mines, Collins does not believe the Savage miners will encounter any serious hazards from concentrations of the gas. For one thing, he said, the mine's ventilation system would rapidly dilute any foul air, and for another, many of the old stopes and drifts in the Comstock were heavily backfilled with lowgrade ore, leaving little space for accumulations.

Digging through the files of the Nevada State Historical Society, the Mackay School of Mines and other local libraries, United Mining personnel obtained a wealth of old mining maps, and now the Savage crews have a pretty fair idea of what lies ahead. In fact, these maps and a significant amount of geological data left over from an extensive mining effort in the 1920's prompted United Mining's decision to go ahead with the project, Collins said. "It's a strange feeling going in there with a lot of the information the old-timers never had," he said.

"From an historical viewpoint, it's almost a tremendous burden in a way," Collins added. "Though you'll find a lot of history of the Comstock in a broad sense, the exact mining methods and everyday life underground just was not recorded and the people aren't around anymore to tell us what the real problems were. In that sense, ours is really a pioneering effort."

At least one fact is certain. The thought of Federal mine safety and health rules on the wide-open frontier a century ago would have been unthinkable to the original pioneers. After all, life on the frontier was risky for everyone, not excluding the underground hardrock miner. The responsibility for his safety was clearly on his own shoulders, certainly not on those of the shareholders, many of whom lived in San Francisco and New York and could have cared less.

Though it only made economic sense to invest in the safety of a mine's workforce, many shareholders simply milked the companies dry. Money often was wasted on unsuccessful experimental milling techniques and heavy machinery that became obsolete as soon as it was developed. Still, the welfare of the miners was not entirely neglected. Several miners who had arrived during the early years of the strike eventually rose through the ranks to become foreman, superintendents, and even mine owners themselves. And luckily for many miners in their employ, several of these men never forgot their roots.

John P. Jones, a superintendent of the Crown Point mine who later became a U.S. Senator, almost suicidally descended into the burning depths of the operation during the 1869 fire in a successful effort to divert a spray of steam into the affected areas. And when miners were digging out the riches of the Consolidated Virginia's Big Bonanza in the late 1870's, John W. Mackay, a part-owner and one-time day laborer himself, made thorough safety inspections of the drifts and heavily timbered stopes every night.

Modern management practices, safer methods, and an obviously strong feeling of moral obligation among the current owners have created a climate of safety at the New Savage Mine that would have been like another world to the 19th Century miner. And, of course, Savage employees must live by the rules promulgated under the Federal Mine Safety and Health Act of 1977, a law that Haldeman believes was long overdue for application to

The Sutro tunnel, a drainage drift nearly four miles long which was completed in 1878 to service the deep workings of the Comstock Lode, intersects the old Savage Mine at the 1,650-foot level. Shown here in a photo taken some time after 1880, the tunnel is expected to help control moisture and increase ground stability at the New Savage Mine operation.

larger operations but can represent both a compliance problem and a financial burden for some small "Mom and Pop" mines operating on a shoestring budget.

This viewpoint was reflected at a February meeting of MSHA training officials and independent mine operators at which several Nevada operators and miners heatedly expressed their dissatisfaction with MSHA's safety and health training requirements. Ronald J. Hawley, then an MSHA training administrator who since has gone into private business, suggested that the mine operators form an ad hoc committee which could serve as a clearinghouse for information on training and other MSHA requirements.

Ray Westcott and Teri Kellerer, respectively the New Savage's general foreman and safety coordinator, were among the first to sign up among the group of 35 operators. Since then, they have helped to organize three meetings among committee members and compiled findings of a questionnaire distributed to all Nevada surface and underground metal and nonmetal mining operations.

Among other things, they found that few of the smallest operators had either the resources or special knowledge to satisfactorily put together the approved training plan required by MSHA. Borrowing material from the training plans approved for use by larger coal and metal and nonmetal mining companies, they have since compiled three new training plans for independent mine operators.

Westcott said the committee also has aided many operators in finding solutions to specific safety problems. "Nobody wants to get fined for a violation, so when these people had problems, they were afraid to go to MSHA for help," he said. "Now they call committee members, and if we don't have a solution, we'll call MSHA in Reno and find out."

"Like any operation, we have had a few problems, but I guarantee you when we find out about them, we take care of them right away," Westcott added. He is quick to give credit to his crews of experienced miners.

One of Westcott's hardrock hands is Charlie Marrujo, the lead miner on day shift. He remembers sipping champagne after shift the day the first round at the Savage was shot. And when the Savage crews finally hit the Comstock Lode in April this year, Marrujo and several others celebrated in a number of Virginia City's saloons, many of which are still graced with elegantly carved bars, Tiffany chandeliers, and the diamond dust mirrors that once reflected the sweating faces of other miners who drank to the lode a century ago.

"We worked our butts off to get down there, and I'll tell you, it was a great feeling when we finally hit it," Marrujo said.

One of the biggest thrills for Marrujo and his buddies came when they broke into the little abandoned drift from the old Hale and Norcross shaft. "You know, I've been mining for about 11 years, have always heard about Virginia City and the old days, and just never dreamed that someday I'd be working underground where those old-timers worked before," Marrujo said.

"When we hit that old drift," he said, "it was just unreal, like stepping into the past. In fact, it was just beautiful."

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Union Safety Concern; an Interview With UMWA President Sam Church

When Sam Church, Jr., 43, assumed the presidency of the United Mine Workers of America in November 1979, he pledged that mine health and safety would be given a top priority in his administration. "The only way to successfully promote the use of coal," he said, "is to reduce the cost of human life to mine that coal."

The son of a disabled coal miner, Church began his mining career in 1965 at Westmoreland Coal Co. operations in Virginia, where he was a mine electrician and served as mine committeeman, safety committeeman, financial secretary and local UMWA president. Following a series of jobs at the UMWA international headquarters in Washington, D.C., he was elected vice-president in June 1977. In the following interview with Mine Safety and Health magazine, Church outlines his views on miner health and safety, particularly emphasizing the importance of training for new miners.—The Editor

MSH: *Your father was a coal miner for several years, and I understand he was disabled by a mining accident in his youth. I would imagine this has had quite an effect on your own attitudes about mine safety and health.*

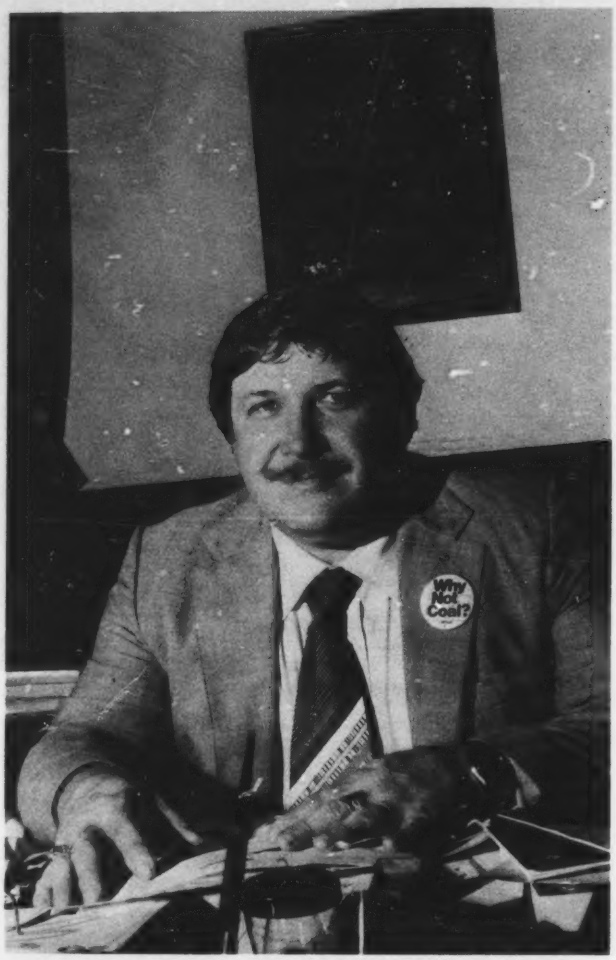
President Church: Yes, my dad worked about 11 years in the mines. When he was 23, an empty coal car was pulled across his leg at about the ankle, and he nearly lost his foot. This did make an early impression on me about the hazards involved in mining, and, of course, so did the many stories I heard when I was growing up.

MSH: *Did this spark your interest in union affairs?*

President Church: Well, I grew up in a union area, and I knew that the union could play a strong role in the area of mine safety and health as well as in many others. At home, there always was a lot of discussion about union affairs, and when I graduated from school, I went to Baltimore and worked in a packing house where I became involved with the AFL-CIO. In fact, I served two years as a safety committeeman. In 1965, when I heard things had improved back home, I went back and got a job in the mines and became active in union affairs there. First, I served as a mine committeeman, then secretary of the local, then as a safety committeman. That's how I got started.

MSH: *As a former safety committeeman, how do you view the extensive changes in mine safety and health law and attitudes over the last 10 or 20 years?*

President Church: Well, I'll never forget my first safety inspection with the Federal and state inspectors. That would have been in 1968, and I remember we knew at least a couple of weeks ahead of time that they were coming. They arrived on the section about ten o'clock, took some rock dust samples, some air samples, then left the face about eleven-thirty on the insistence of the mine superintendent who told them their chicken dinners were getting cold in the mine office.


To United Mine Workers of America President Sam Church, Jr., improved mine safety and health education and training must be the cornerstone of any program to curb fatalities, injuries and job-related illnesses in coal mining.

Why Not Coal?

Of course, there has been a drastic change since then with passage of mine health and safety legislation. The inspections now are much more thorough. They come in unannounced. Still, you'll find problems. In any organization where you have a large workforce, there'll be people who do their job a lot better than others. But the mines today are definitely kept up much better, and I think that is reflected in the reduced injury and fatality rates over the years.

MSH: *How do you view the role of the safety committeeman under your administration?*

President Church: We'll continue to stress contract education so that the safety committeeman doesn't violate the contract in the performance of duties. In this regard, the 40 hour classes on the contract have been very helpful. When it comes down to it though, most of the safety training really isn't formal training in the classroom sense . . . it's on-the-job experience more than anything.

The role of the mine safety committeeman should never be underestimated. In many cases they are harassed, and they don't get paid much. They are necessary though, and over the years, they have helped considerably in effecting safety in the mines.

MSH: *In some of your public statements, you have discussed the need for an increased cooperative effort among the coal industry, the union and MSHA, both in strengthening the industry and in some areas of mine safety and health. Do you think the cooperative effort has been effective, and do you have any suggestions for achieving better cooperative relations among all parties?*

President Church: It's working better than it has in the past. I think we get good cooperation from MSHA. Bob Lagather has been very willing to help us with specific problems, and I think his interest is sincere. You see him down in the mines, in the coalfields, and he's been very active and outspoken. In fact, I think he has taken charge at MSHA better than anyone they've ever had.

With industry, I think we're seeing a better attitude, especially in the area of education and training. Recently we worked out a training film between industry, MSHA and the union. And, for a change, I'm hearing some operators say that a safe mine is a productive mine, something I did not hear in the past. Often when operators speak out against Federal regulations, it seems that they are talking about the Office of Surface Mining, the Environmental Protection Agency or some other organization. You don't hear as much protest as you used to about safety and health regulations. Apparently, some operators are learning to live with the law.

Also, I think, some operators are putting a lot more money into their safety programs. Still, there are problems. You might have a big corporation throwing a lot of money into their safety program, but there will still be serious problems at a few of their mines. A lot really depends on mine management at individual operations. You know, it's not hard to keep a mine up, but once you let it deteriorate, it is both difficult and expensive to catch up. It only makes sense to keep a mine up as you go.

MSH: *With renewed interest in coal as an alternative to oil and nuclear power as an energy source, do you believe that a large increase in coal production can be achieved with adequate safety and health protection to the miner?*

President Church: Yes, I do. The experienced miners now out of work will be called back, but there will also be a lot of new people coming into the mines as well. The key, I believe, is training these people from the outset. When coal production was picking up in the early 1970's, one of the big problems was lack of training. In the 1974 contract we had a clause that said a new miner could not run equipment until he had been in the mine for 90 days. Many operators at the time just did not see this as a chance to train their people. In many cases, they just stuck a man off somewhere shoveling on a belt line and by the time the 90 days were up, he'd be put on a piece of equipment he'd know very little about.

In recent years, some states have developed some worthwhile training programs, and the companies who have put an emphasis on training are realizing that it pays off in terms of good safety and production. There has to be a strong emphasis in this area when coal production expands.

MSH: *Do you feel that the use of joint UMWA-MSHA committees such as the committee on underground mine illumination, technology and requirements have been productive? Should such efforts be expanded to address a number of other safety and health problems?*

President Church: In that particular area, it was extremely helpful. As you know, there had been some resistance to illumination requirements because of several unresolved problems. We managed to overcome them to a great extent. I've not yet had the opportunity to extensively explore other areas where such committees would be useful, but I expect they will be of great help in the future.

MSH: *In this connection, what major types of coal mine hazards would you like MSHA to pinpoint for special attention, and what areas of research and development for engineering solutions should be pursued?*

President Church: Roof falls still account for the highest percentage of fatalities and injuries in underground coal mines, and finding solutions in this area must continue to be one of MSHA's main concerns. The automated temporary roof support systems (ATRS) on roof bolting machines appears to be one of the best approaches, and I would urge that MSHA continue to work hard in that area. Some of the research work done in this area seems to be real promising. I'd like to see it pursued vigorously.

MSH: *In recent years, a new generation of younger miners has entered the mines. Is this having any effect on health and safety conditions?*

President Church: It's like anything else. It really depends on the training they receive. I'm not sure that the young person today is all that different than in the past. I think we are seeing a more educated young person now who has a better understanding of his rights under the contract and the law. It used to be that a father would take his son into the mines and be responsible for teaching him safety. Today, that responsibility lies with the operators. With an increased emphasis on teaching a person safety . . . how to run the equipment, I think new miners will have a much better chance to avoid the hazards which resulted in so much suffering in the past. Training will make the big difference.

(Continued on Page 27)

Nevada State Inspector of Mines Bill DuBois has found that mining companies have responded well to his mine safety presentations emphasizing the economics of safety. Using data which show the high cost of accidents and injuries to the operator, he is able to help company safety directors to pinpoint weaknesses in their safety programs. In more than one instance, DuBois has found, a mine official known for his strong sense of moral obligation to the workforce has been astounded to learn that more can be done both to protect workers and cut production costs.

Accident-Injury Figures Tell the Story

Nevada's Bill DuBois Has His Own Way of Effectively Selling Safety

By John McGrath
MSHA Staff Writer

Nevada State Inspector of Mines Francis "Bill" DuBois recently recalled the day he convinced the general manager of one of the state's large copper mines to beef up the company's safety program. "It didn't take much," DuBois said. "All I had to do was to show him the cost of his state worker's compensation premiums, and he just about went through the roof.

"That alone was all it took for that company. I just made them aware of the total figures on injured workers and the active claims, and immediately those people went to work." DuBois said the company subsequently improved its safety program and significantly reduced injuries.

Since his 1975 appointment to the state post, DuBois has made many similar presentations to mine company officials, and he is convinced that this economic approach, coupled with the state's mine safety training efforts, have literally paid off—both in human lives and on the ledger sheets of mine company accountants. "The way I see it, a mine operator should not be in business in the first place unless he has a strong feeling of moral obligation toward his workforce," DuBois said. "Still, we have to be realistic."

The pragmatic approach, DuBois believes, involves realizing that a mining company is, after all, a business. "Changes are made when a business is prompted by an economic incentive in the pure sense," he said. "It does not mean that nobody cares about the miner. Nobody wants to see a fellow human being hurt. It really boils down, at times, to a communications problem within a company.

"Out at the mine site, the local management people are in touch with the everyday problems, but back at corporate headquarters, the company accountants might only have a vague idea. Once these officials see the results of a poor safety program in numbers, it just makes more sense to invest in one that works."

The numbers that DuBois uses in his presentations are drawn from the computer banks of the Nevada Industrial Commission (NIC), the state agency that administers the state's worker's compensation program and enforces occupational safety and health laws. Among other responsibilities, the NIC establishes the rate of premiums employers pay for worker's compensation insurance, rates based on the employer's safety and health record.

For the purposes of setting rates, there are seven classifications for mining: underground, open pit—metallic, open pit—sand and gravel, diatomaceous earth milling, ore reduction plants, ore processing, and well drilling. A rate is established for each classification, based on the total amount paid annually in compensation and medical benefits to workers. Individual employers within each classification pay a premium which is higher or lower than this rate, according to the amount paid in claims to their own employees during the previous five years. In essence, employers whose operations have an above-average rate of injury and illness pay higher worker's compensation premiums.

With this in mind, DuBois devised a formula for giving a mining operator a rough estimate of both the direct costs—annual medical and indemnity expenses (claims paid)—of an accident and its indirect costs (such as repair of damaged equipment, training of replacement personnel, and the loss of production on the remaining shift). Though the direct costs are obtained right from the NIC computer, the indirect costs must be estimated since DuBois does not always have access to company records. Even so, based on formulas that have been developed over the years by industrial safety experts, DuBois figures the indirect cost is at least double that of the direct—a conservative guess since that figure can often run as high as ten times the direct cost, he said. By his calculation, then, the estimated total cost of an accident that involves an injury, adding in the direct cost and twice that amount, is three times the initial cost that shows up on the NIC record. (For example: if accidents involving injuries cost an employer $4,000 in average direct costs annually, DuBois would estimate the total cost to be $12,000.) The cost of accidents which do not cause injuries, DuBois believes, can amount to as much as half of the accidents-with-injuries total, or in this case, about $6,000, for a total estimate of $18,000 in annual losses.

But DuBois often goes a step further. Whenever possible, he obtains the company's annual production figures, net operating profit, and other data so he can provide an estimate of accident-injury-illness cost in whatever form is most relevant to the operator—in terms of dollars, percentage of gross sales, tons produced and even the number of production days needed to cover accident costs. When he must guess at some of the figures, he intentionally keeps his estimates low. Understatement, he said, is often the most persuasive approach.

"The kind of response I would get from the operators," DuBois said, "is 'You know, we'd never looked at it this way before. . . .' What you really hope for is that you've planted a seed for them, to start them thinking along the lines of safety."

Several years ago, DuBois held discussions with officials of the Greystone Mine, a Dresser Minerals barite operation in Lander County that had experienced a disabling injury frequency rate well above the national rate for similar operations that year. DuBois presented a detailed estimate of the mine's estimated accident costs, and, fortunately, officials from Dresser's home office were on hand to hear the presentation. Shortly after further consultation with DuBois, company officials redefined the safety responsibilities for their supervisors and appointed a new safety officer.

Robert Bevins, Dresser's manager of safety and environmental control, credits DuBois for helping to inspire the changes. "It doesn't often occur to production supervisors just how much money they can save," he said. "When they hear staff people like myself point this out, it kind of goes in one ear and out the other. It has more impact on them when they hear it from somebody from outside the company who obviously doesn't have that much to gain."

DuBois' effort, Bevins recalled, influenced the operation to "get more committed to a safety-committee type program, rather than one administered by the company where the employees don't have that much to say." Bevins said that DuBois' presentation gave the local joint labor-management committee the shot in the arm it needed.

"His approach at the time was, 'You've got money to save; together, we can help to save people from getting hurt.' It's a lot different from saying 'If you don't do it, we'll fine you.' . . . . It's a nice approach."

Bob Malone, manager of safety and security for Kennecott Minerals, also gives DuBois high marks for effectiveness. As safety director for Kennecott's Nevada Mines Division, Malone met the state inspector on one of his visits to a company operation at McGill.

"Bill discussed with us his economic approach to safety," Malone said. "We were very impressed and decided to modify our existing program to include his ideas."

"He met with our local management in Nevada and then presented a program for all our supervisory personnel which stressed management techniques toward safety. The supervisors felt the program was excellent and invited him to return to conduct MSHA instructor certification courses. With his help," Malone said, "we made a good program better."

The Greystone Mine, a Dresser Minerals barite operation in Lander County, Nev. Dresser's manager of safety and environmental control attributes beneficial changes in the mine's safety program to a presentation on accident costs made by State Inspector of Mines DuBois.

The record supports Malone's judgment: According to MSHA's Health and Safety Analysis Center, there were no lost-time accidents at the McGill operation during 1979.

The NIC data has other important uses in the state's mine safety and health program. In training classes for mine supervisors, DuBois often reads aloud brief summaries from NIC reports of accidents that have occurred at operations where the supervisors are employed. Since the events and individuals are familiar to the supervisors, DuBois said he finds it easy to impress his students with the importance of accident prevention.

Data from NIC's computers has also been helpful in targeting special areas for emphasis in training courses. Assistant state inspector Bud Blaylock, who covers mines in northwestern Nevada, regularly culls specific information from the reports for use in state-conducted first-aid classes. "We see a lot of eye injuries in this part of the state, for instance, so I take special care to talk about the proper emergency procedures in eye injuries."

In recent years, the enforcement role of the state inspector has decreased as the training role has expanded. Though Nevada state inspectors conducted 528 annual inspections in 1979, they have increasingly focused on other aspects of mine safety and health.

Using funds from the state and an MSHA grant, DuBois and his staff of four inspectors have been particularly active in conducting MSHA certified instructor training and first-aid. DuBois said the need in this area has risen considerably with the explosive growth of Nevada's mining industry in recent years. Of the state's more than 400 surface and underground operations, about 50 have come on line since January of this year. Roughly 60 percent of these are small operations and many are located in remote areas, far from well-equipped medical facilities.

For this reason, first-aid training has become one of the state's top priorities. DuBois estimated that he and his staff have trained about 4,000 miners since 1975. He points with pride to several documented cases in which first-aid treatment has saved miners' lives, and he is convinced that improved first-aid training has contributed to lower accident severity rates.

Even so, things could be better, he said. For one thing, an apparently high employee turnover rate at metal and nonmetal mines throughout the West often taxes the capacities of both state and Federal training personnel. In addition, the isolation of many small Nevada mine operators has sometimes made communications regarding state and Federal regulations difficult.

Attempting to open lines of communication, DuBois has tried a number of strategies. After Nevada was awarded a grant from MSHA, he solicited suggestions from all state mine operators in order to most effectively use the funds to promote safer mining. DuBois' agency also regularly publishes a newsletter for operators that contains general safety information and updates on Federal and state regulations. The state has also conducted several workshops for operators on the training plans they must develop to satisfy MSHA's training requirements. And DuBois has enthusiastically lent his support to an *ad hoc* committee of small mine operators formed last February to share training and other regulatory information among themselves.

"I think that this is a classic example of state participation in a Federally-mandated program," DuBois said. "We have worked closely with MSHA, particularly on our training efforts, giving the kind of assistance the small mine operators here desperately need." Mike Lacey, the MSHA training officer based in Reno, agrees. "With our limited resources, it would be impossible for us to cover them all," he said. "Bill really fills in a lot of gaps."

"What you do is present yourself and try to advise them, to stir up the water—to make them aware that they have got to make the changes. The way I see it," DuBois said, "our role has been that of trying to gain their trust, let them know we are there to help and advise." He firmly believes that governmental agencies must counsel as well as enforce.

Has his "incentives" theory worked? "I don't have any hard answers," DuBois said. "I've looked at the results from an industry, rather than an individual company standpoint." He noted, however, that Nevada's open pit mining industry now has a lower rate of accidents than Nevada's restaurant and casino industries do. And he added that, while the actual number of reported mine accidents has risen slightly in recent years, NIC data on the amount of claims paid shows that the severity of accidents has been decreasing. "Certainly in the area of first-aid training," DuBois said, "we have satisfied a lot of needs. It's something they can tangibly use that hasn't cost them anything."

DuBois said, "We have tried to show the operators that we can provide a useful service to them, something they can use and they have been very responsive. . . . I think that looking back over the last five years, all the things we have done, whether it be training, consultation, or enforcement at the state or Federal level, have had the net effect of making the industry more aware of accident control—the economics of it, the humanitarian aspect of it, and certainly the legal ramifications of it . . ., and now there's more involvement on the part of the entire mining industry . . ."

Update

New MSHA Policy, Rule on Independent Contractors Issued

MSHA recently issued a final rule to implement its new enforcement policy of holding independent contractors at mine sites responsible for their violations of mine safety and health laws and standards. Previously, MSHA cited the mine operator for all violations occurring on mine property, including those committed by independent contractors or their employees.

The new rule, which affects coal and metal and nonmetal mining operations, requires mine operators to keep a register of information on all independent contractors present at the mine. The register must contain the contractor's trade name, address and telephone number, as well as a description of the nature and location of the work to be performed. Also to be included is the contractor's "address of record" to enable MSHA to serve citations by mail, if necessary. The register must be available to MSHA on request.

In addition, the new regulation establishes procedures by which any independent contractor performing services or construction on a mine site may voluntarily apply for a permanent MSHA identification number. Those contractors who do not apply for an identification number will be assigned one on the first occasion that MSHA issues them citations or orders. The number, which will not change even if the contractor moves to a different mining operation, will be used by MSHA in maintaining the contractor's compliance history for civil penalty assessments.

Criteria and guidelines proposed last August for identifying certain independent contractors as operators were not included in the final regulation. The criteria, which would have considered whether a contractor was performing "major work" and maintaining a "continuing presence" at the site, were criticized by members of the mining community who provided comment and testimony on the proposal. MSHA subsequently concluded that miners would be most effectively protected by holding contractors liable for all of their safety and health violations.

As an appendix to the final regulation, MSHA published a statement of the new policy for independent contractors, together with guidelines concerning application of certain regulations, including the training standards in Title 30, Code of Federal Regulations, Part 48.

Contractors at the mine site who are not engaged in surface construction, in underground construction at mines not operating, or in shaft and slope work (and are thereby exempt from the training requirements in Part 48) must receive the required training. Contractors may, however, acquire this training under an existing operator training plan as an alternative to establishing their own plans.

The guidelines also outline an enforcement policy for those occasions in which the mine operator's and the contractor's responsibilities for compliance overlap. MSHA may cite the operator in the case of violations committed by the contractor when the operator has contributed to the violation, the operator's employees are exposed to the hazard, or the operator has control over the hazard.

The new regulation, Title 30, CFR Part 45, took effect on July 31, 1980. The new enforcement policy for independent contractors became effective with the publication of the *Federal Register* notice on July 1.

MSHA Issues Guide To Miners' Rights And Responsibilities

MSHA has issued a 35-page booklet, "A Guide to Miners' Rights and Responsibilities Under the Federal Mine Safety and Health Act of 1977", intended to help the nation's miners take an active role in protecting their own safety and health. The pocket-sized handbook describes the many rights and responsibilities which the Act extends to miners, their representatives, and applicants for mining work.

"A good safety and health program depends on the active participation and interest of everyone at the worksite," the booklet states. "If you and your fellow miners take advantage of these rights, you can help decrease workplace deaths, injuries, and illnesses."

Rights addressed in the booklet include the following:

- The right to have a representative of miners accompany federal inspectors during inspections at the mine;

- The right to obtain an inspection of a mine where there are reasonable grounds to believe that an imminent danger, or a violation of the Act or a safety or health standard exists;

- The right to pay during certain periods of time when a mine or a part of a mine has been closed because of a withdrawal order;

- The right to be protected from discrimination based on the use of rights given by the Act;

- The right to appropriate safety and health training; and

- The right to be informed of, and to participate in, enforcement and legal proceedings under the Act.

The booklet includes a directory of MSHA offices and maps showing the agency's districts.

MSHA is making an effort to distribute the booklet to as many miners as possible. Copies, singly or in quantity, are available free of charge from any of the 10 MSHA training centers or from any MSHA metal and nonmetal field office. In addition, five major unions are being supplied with copies for distribution to their members. All mine operators are being provided with sample copies and a flyer announcing the booklet's availability, which can be posted on the mine bulletin board.

For the address of the nearest training center or field office where copies can be obtained, write the MSHA Office of Information, 4015 Wilson Blvd., Arlington, Va. 22203.

Bernard Assumes Duties as Director of Technical Support

Roy L. Bernard recently was appointed director of MSHA Technical Support, succeeding Donald P. Schlick, who has resigned to take a position with private industry. Bernard, who assumed his new duties on July 28, has served as deputy administrator, Metal and Nonmetal Mine Safety and Health, since February 1979.

The director of Technical Support is responsible for coordinating MSHA's scientific and engineering efforts to solve technological problems encountered in enforcing the 1977 Mine Safety and Health Act.

Bernard began his career in government as an inspector for the Bureau of Mines after graduation from Wisconsin Institute of Technology. In his 23 years of Federal service, he also has been chief of the safety division for Metal and Nonmetal Mine Safety and Health, and a district and subdistrict manager with MSHA and its predecessor agency, the Mining Enforcement and Safety Administration.

Zabetakis Leaves Academy to Take BCR Research Post

Michael G. Zabetakis, who has served as superintendent of MSHA's National Mine Health and Safety Academy for the past five years, has become director of research for Bituminous Coal Research, Inc., the research affiliate of the National Coal Assn. Zabetakis will handle day-to-day planning and direction of the BCR technical research program.

Zabetakis came to the Bureau of Mines in 1949 where he was a physicist, physical chemist, branch chief, and research supervisor in methane control, ventilation and other technical aspects of coal production. He is the author of numerous books and other publications, principally in the fields of safety and cryogenics, and, for four years, was mathematics professor and chairman of the mathematics department at Washington and Jefferson College.

Final Mine Rescue Team Requirements Issued by MSHA

MSHA's final rule on mine rescue team requirements for all underground mines was published in the July 11, 1980, Federal Register. Included in the standard are requirements for the number of teams and their availability, team member experience, health and training, proper rescue equipment, and alternative mine rescue provisions for "small and remote" mines or those with "special mining conditions."

In response to public comments following publication of the proposed rule, MSHA adopted several changes in the final rulemaking. Among others, MSHA reduced the length of recordkeeping periods for team training and physical examinations from the proposed two years to one and reduced the required number of alternate team members from two to one. In light of the rapid employee turnover at some operations in recent years, MSHA eased underground experience requirements for team members in an effort to expand the pool of available team candidates. The previously proposed experience requirement and initial training for people already serving on mine rescue teams was waived in the final rule.

Under the final standard, a mine that meets the new definition of "small and remote" or an operation that may have "special mining conditions" may submit an alternative mine rescue team plan to the appropriate MSHA district manager for approval. The combined underground employment of the operator's mine and any surrounding mines within a two hour ground travel time must be fewer than 36 people for the operator to meet the definition, "small and remote." This definition is meant to apply only to the rescue team standard, Part 49, Title 30, Code of Federal Regulations, and is not intended to be a source of interpretational guidance where the terms "small" or "remote" appear in other sections of the Act.

To allow sufficient time for manufacturers to make rescue equipment available, and for operators to recruit and train rescue team members, MSHA has included in the final rule a delayed effective date of one year from the date of publication in the Federal Register. MSHA has emphasized that the regulation is not intended to alter the widespread tradition of voluntary mine rescue teams in the mining industry, and that the agency expects that many mines and teams will voluntarily exceed minimum requirements of the new rule.

For further information, contact: Frank Delimba, chief, division of safety, Metal and Nonmetal Mine Safety and Health, at (703) 235-8646; or Herschel Potter, chief, division of safety, Coal Mine Safety and Health at (703) 235-1284.

News and Notes

Legal Briefs in Mining

Secretary of Labor v. Oracle Ridge Mining Partners, FMSHRC Docket No. WEST 79-248-M, decided June 6, 1980.

The Federal Mine Safety and Health Review Commission reversed the decision of an administrative law judge who ruled that Oracle had violated a standard for explosives magazines. In part, the standard requires that magazines be "constructed substantially of noncombustible material or covered with fire resistant material." The magazines in question were located in a cutout on the side of a mountain and were constructed of thin aluminum sheeting and lined with plywood inside. The inspector cited the company with the belief that the magazines could not withstand a fall of overhead rock.

The administrative law judge relied on the definition of "substantial construction" contained in Title 30, Code of Federal Regulations, but the company argued that the intent of the standard was only to reduce the chances of fire. The Commission agreed, saying that the latter part of the phrase in the regulation, "or covered with fire-resistant material," established that the standard was directed at fire prevention of the magazine and not to density of construction.

Secretary of Labor v. Hecla Mining Co., FMSHRC Docket No. WEST 79-251-M, decided April 1, 1980.

Hecla was cited for a violation after a skiptender opened a man-hoist (cage) door about 40 feet before the hoist had reached the station. Hecla argued that the company could not be found in violation based solely on the employee's failure to comply with the company's safety policy. The administrative law judge said that under the 1977 Act, an operator can be held liable for violations of mandatory standards without regard to fault. A civil penalty of $15 was assessed.

Secretary of Labor v. C.C.C.-Pompey Coal Co., Inc., FMSHRC Docket No. PIKE 79-125-P, decided June 12, 1980.

The Federal Mine Safety and Health Review Commission reversed the decision of an administrative law judge who ruled that the company had not violated a standard which prohibits the accumulation of loose coal dust in underground coal operations. Though the dust had accumulated, the administrative law judge said, the MSHA inspector who cited the company failed to establish the time it took for the accumulation to occur and therefore failed to determine whether the operator had a reasonable time to clean it up.

The Commission held that the judge had failed to follow prior Commission precedent with his ruling. In a previous case, the Commission ruled that when accumulations of dust occur, a violation of the standard exists regardless of the time it took for the accumulation.

Quarto Mining Co., v. Secretary of Labor and United Mine Workers of America, FMSHRC Docket No. LAKE 80-44-R, decided April 18, 1980.

Quarto contested the issuance of a withdrawal order by MSHA for a violation of the company's approved roof control plan, arguing that the violation was not the result of "unwarrantable failure." The administrative law judge upheld the withdrawal order on the grounds that a foreman employed by the company knew of the violation beforehand and failed to correct the condition before the end of shift.

Secretary of Labor v. C.S. & S. Coal Co., U.S. District Court, Eastern District of Pennsylvania, Docket No. 79-4511, decided May 28, 1980.

The defendants, C.S. & S. Coal Co., denied entry of Federal inspectors. They argued that their rights of due process were violated under the Federal Mine Safety and Health Act of 1977 since the law did not provide for a hearing prior to the issuance of citations or orders for violations. Among other uncontested findings of fact in the case, the defendants had failed to abate the conditions cited, and declined to participate in the hearings process under the 1977 Act.

The Federal district judge granted an injunction reasoning that the defendants had been entitled to an "elaborate" review process under the 1977 Act, including the opportunity to request temporary relief from any order, and, citing prior case law, said an official body can take "summary action pending a later hearing," when the public interest clearly outweighs the infringements on private interest. For those reasons and others, the judge issued an order granting the Secretary the permanent injunction which contained an order that the defendants admit MSHA inspectors to mine property without interference; and an order prohibiting the defendants from operating the mine until the orders and citations issued by the Secretary were abated.

Black Mesa Mine Given Safety Award

Peabody Coal Company's Black Mesa Mine in Northeastern Arizona has been awarded the company's Robert H. Quenon Safety Award for 1979, based on a record of 356 employees' 14 months and one million consecutive employee hours of operation without a lost-time accident. At the same time, the surface coal mine, located near the village of Kayenta, reached production of nearly four million tons.

Joseph O. Johnson, mine superintendent, credited the record to the efforts of the employees, the work of the mine safety committee and the division's safety staff.

The award, named for Peabody's president and chief executive officer, goes annually to the company mine showing the greatest improvement in a calendar year, based on accident frequency, severity and incidence rates. Black Mesa won in all three categories.

MSHA Broadens Mine Structure Analysis Program

Expanding its original function of conducting on-site investigations and engineering analyses of mine waste disposal facilities and impounding structures, the Denver Technical Support Center's mine waste and construction technology division now resolves structural design problems of a wide variety of mine facilities and systems.

As a result of the 1977 Federal Mine Safety and Health Act, the division's role was broadened to include design analyses of timber and steel headframes, concrete retaining walls, storage bins, hoppers and overhead crane support systems.

"The primary concern in evaluating mine facilities and systems is to determine if they can operate safely when exposed to design loadings," division chief Robert Fujimoto explained. "Engineers usually require an on-site inspection and evaluation of the facility or system, plus a technical evaluation of the structure."

For indeterminate structures, or those for which the applied force system cannot be determined through application of the three-condition equation for static equilibrium, a computer program is often applied in conducting the analyses. The Mine Waste and Construction Technology Division uses the Water and Power Resources Services' engineering computer program entitled, "A Structural Analysis Program for Static and Dynamic Analysis of Linearly Elastic Systems."

The program, under development for 16, years, can be used for static and dynamic analyses of structures ranging from a simple cantilever system to a complex three-dimensional hoist headframe. It is capable of handling 2,500 unknowns. Provided that engineering properties, such as density and stress-strain relations, are known, the structure can be a combination of steel, concrete, rock, brick or other construction materials.

"The program is sophisticated, but is a necessary tool in evaluating complex structural systems such as headframes," Fujimoto said. "As the degree of unknowns for a given structure increases, a reliable computer program becomes invaluable."

To assist the engineer in reading computer input and output data for the structure, the program language is in free format—that is, the engineer can use common engineering terminology to describe the structure and output is printed in the same language. The program's option for three-dimensional graphical or pictorial output also aids the engineer in determining if the input structure's configuration, orientation and displacement are correctly described.

Introduced to the division by field inspectors concerned about the operational safety of mine-site structures, both existing and proposed systems have been analyzed. One of these was a timber headframe and storage bin on which an extensive computer structural analysis was performed to evaluate the safety of the headframe for hoisting miners. The structure showed signs of stress, including leaning and broken parts. The analysis confirmed that modifications were needed.

Another example was the investigation of steel column base plate anchor bolts to determine why they failed during erection, leading to the death of a worker. A simple structural analysis indicated the bolts were not adequately located or embedded to withstand even minor erection loads.

An inspection and structure evaluation of five reinforced concrete bulkheads for water retention and storage in underground drifts determined four bulkheads to be unsafe. Redesign and new construction were recommended.

"Our goal is to address all civil engineering-type problems that come to our attention. And with the establishment of new regulations concerning mining and milling construction facilities, it is possible that structural-related problems could increase," Fujimoto said.

For further information on the structural program, contact the mine waste and construction technology division, (303) 234-2358, Denver Technical Support Center, P.O. Box 25367, Denver Federal Center, Denver, Colo. 80225.

Holmes Safety Assn. Is United by Common Goal

The ongoing success of the Holmes Safety Assn. is an operating example that, despite diverse private interests, the many elements involved in the mining industry are bonded by a common concern . . . safety.

With a membership of representatives from safety organizations, mining companies, industrial insurance companies, trade and labor organizations, civic organizations, and state and federal agencies, the 54-year-old association is dedicated to preventing fatalities and injuries, and improving health and safety in all phases of the mineral industry. Since its founding, membership has grown to 210,000 in 43 states.

The Holmes Safety Assn. is a subordinate body of the Joseph A. Holmes Safety Assn., formed in 1916 by the nation's leading safety organizations representing the mineral and allied industries. The private, nonprofit association now operates independently through a national council, four state councils, 43 district councils and 1,429 affiliated chapters. It provides information to the public on mine safety and health, and promotes education and training programs in first aid and mine rescue and recovery operations.

Part of the association's efforts at stimulating the safety movement in mining is through an extensive awards program, including annual awards for individual heroism, individual safety achievement spanning 10 to 40 years' employment, and outstanding safety performance by participating companies or safety organizations. The highest

In the event of a serious metal and nonmetal mine emergency, the 19 members of MSHA's National Metal and Nonmetal Mine Rescue Team would respond to the task from MSHA offices throughout the country. Team coordinator J.D. Pitts, (upper left), selected the men from nearly 80 volunteers based on their mine rescue and recovery experience, personal attitudes and geographic location. The team had an important role in the recovery of bodies of five men who died in the Belle Isle salt mine explosion in Louisiana last year. Front row, kneeling, left to right are; John Austin, Dan Haupt, Larry Aubuchon, Paul Grubb, Cosme Gutierrez, Jake DeHerrera, Tom Garcia, Larry Nichols and Mike Dennehy. Back row, standing, left to right are; J.D. Pitts, Tom Alderete, Edmundo Archuleta, Willard Graham, Bill Tanner, Charles McDaniel, Steve Moyer, Rod Breland, Dan Kleinhesselink, Steve Smith, Dan McMillan.

honor granted by the association is the Merit Award, presented to carefully selected members for "exceptional and unselfish service." By making public the actual safety accomplishments on which the awards are based, the association has helped prove that mining can be as safe as any other "hazardous" industrial work. In 1979, more than 3,000 awards were presented.

"The association is one of the best vehicles in mine safety and health, whereby you can gather together workers, employers, and members of the state, federal, and insurance agencies," a spokesperson said. The association maintains that it benefits industry by arousing the safety consciousness of management and individual employees.

"The needs of each type of industry—deep mining, surface mining, cleaning and processing plants for both coal and noncoal operations—are given special consideration in the technical and training courses. By participating in chapter and council activities, supervisors and workers can obtain detailed analyses of all accidents and accident-prevention programs and receive suggestions on how to improve their safety programs."

In addition to receiving MSHA funding, the association also has access to MSHA accident-prevention program statistics; safety topics; and abstract reports on serious and fatal accidents, mine disasters and explosions to be used at chapter and council levels. The association publishes a monthly bulletin, featuring posters, cartoons, abstract reports for deep and surface mining, and safety topic material, plus complete accident-prevention programs, applicable to any industry or organization.

David Pcsolar, of MSHA's mine electrical systems branch, examines the switch inside the tachograph during a follow-up inspection of the system, which is now in operation at the R & F Coal Co. preparation plant in Ohio.

Haulage Truck Alarm Warns of High Voltage Lines

An alarm system has been developed to reduce the incidence of electrocutions caused when the beds of haulage trucks contact high voltage lines. In the past 10 years, at least five coal and five metal and nonmetal truck drivers have been killed when their trucks accidentally contacted overhead power lines.

Assigned to the project by Assistant Secretary for Mine Safety and Health Robert B. Lagather, MSHA's mine electrical systems branch of the Pittsburgh Technical Support Center produced a simple warning system now in use at the R & F Coal Co. preparation plant in St. Clairsville, Ohio. With the company's cooperation, the system was installed on a Euclid R-85 55-ton truck. The system is designed to sound an alarm if the truck moves with its bed up.

"The system was assembled from off-the-shelf components purchased for about $400 and installed in the field without the need for special tools or skills," Branch Chief Richard L. Reynolds said. "It was easily installed and the operator is very pleased with its operation."

The system consists of a tachograph, a magnet-operated limit switch, a relay, a momentary switch and an alarm. The tachograph was first tested on a MSHA field support van. The results of the tests proved an alarm could be sounded for speeds as low as two miles an hour forward and three miles an hour in reverse.

When the bed of the truck goes up, the contacts of the magnet-operated limit switch close. If the truck starts moving, the contacts of the switch inside the tachograph close to sound the alarm. The alarm stops if the bed is lowered or the truck stops. An override capability is provided by the momentary switch which allows a self-latching relay to energize. This in turn causes the alarm to cease during operations when the driver must move the truck with the bed up.

Since this particular system sounds an alarm only when the truck is moving, it will not benefit drivers who may raise the truck bed for washing and inadvertently hit a power line. According to Reynolds, research is underway to develop a sensing device which will sound an alarm at a predetermined safe distance from an energized power line.

As early as 1973 field tests were conducted on such a device which could be applied to truck beds, crane booms, or drill rigs. However, the results showed that more work was needed to improve the sensitivity of the device in all modes of operation.

"It's a complicated problem. A research firm has evaluated and proposed design improvements to existing sensing devices, but has not been able to achieve a design which will work in all physical power line configurations," Reynolds said. In the meantime, it is believed that the tachograph-magnetic limit switch system could have an impact on reducing these types of accidents.

MSHA regulations state that equipment cannot be operated within 10 feet of an energized overhead power line, which must be at least 15 feet above ground. Where voltage of the lines is 69,000 volts or more, the minimum distance increases. Finally, regulations state that when the clearance between equipment and the power line is less than that required, the power lines must be de-energized.

"The problem is that these regulations alone do not prevent these types of accidents since in most cases the drivers were not aware of the lines until they contacted them," Reynolds said. "If they had known that the lines were there they probably would have avoided them. This is why a sensing device is needed."

Although current Federal regulations do not require a warning system on haulage trucks, the technical resources of the mine electrical systems branch are available to assist mining operations interested in the tachograph-magnetic limit switch system.

"We can't buy all the components for them, but we can assist them in installation," Reynolds said. "We hope to show that devices are available that can aid in reducing accidents without putting a burden on the mine operator."

For information or assistance, contact Richard L. Reynolds, chief, mine electrical systems branch. PH.: (412) 675-6957.

Update

HERE'S HOW TO OBTAIN REPORTS AND FILMS

Single copies of Information Reports are available through:

MSHA, Office of Information
4015 Wilson Blvd., Rm. 1237-A
Ballston Tower No. 3
Arlington, Va. 22203

Films can be borrowed from the National Distribution Center in Pittsburgh, Pa. Send all requests to:

Motion Pictures
MSHA
4800 Forbes Ave.
Pittsburgh, Pa. 15213

Films can be purchased by directing requests to:

Chief, Division of Audio Visual Services
MSHA, Education and Training
4800 Forbes Ave.
Pittsburgh, Pa. 15213

Recent Additions to the MSHA Library

- **IR 1111—Asbestiform and/or Fibrous Minerals in Mines, Mills, and Quarries,** by Walter Bank, 25 pp.

One theory of mineral-fiber-induced lung damage holds that the shape and size of the responsible inorganic materials are significant factors. Asbestiform minerals, fibrous minerals, or elongated cleavage fragments, irrespective of the mineral name applied or definitions employed may, therefore, be significant in a health evaluation of airborne dust. Many minerals in ore deposits and quarries exist in variable forms, including the fibrous shape. Names of such minerals vary, depending on locality, availability of analytical equipment and personnel, traditional usage, and other factors. Because of these factors workers in the mining and associated industries may unknowingly be exposed to abestiform or fibrous minerals.

This report discusses mineral assemblages found in ore deposits and quarries, cites potential hazardous minerals, and predicts where fibrous mineral health hazards might exist. It includes two appendices: Appendix I lists many minerals that occur in asbestiform or fibrous forms or which tend to cleave into elongated fragments. Appendix II lists some selected mines, arranged by commodities and scattered throughout the United States, where fibrous minerals may be found.

- **IR 1121—Standard Calibration and Maintenance Procedures for Wet Test Meters and Coal Mine Respirable Dust Samplers** (Supersedes IR 1073), by Thomas F. Tomb and Harry N. Treaftis, 14 pp., 2 Tables, 5 Figs.

The Mine Safety and Health Act of 1977 requires that the average concentration of respirable coal mine dust be measured with an approved device. Regulations specify that the approved sampling device be calibrated at a flowrate of 2.0 liters per minute or at a different flowrate prescribed for the particular device. This report presents the standard procedures for calibration of currently approved personal samplers and associated equipment, and maintenance procedures for the equipment. It is incorporated by reference in the new mandatory dust sampling regulations which were issued April 8, 1980.

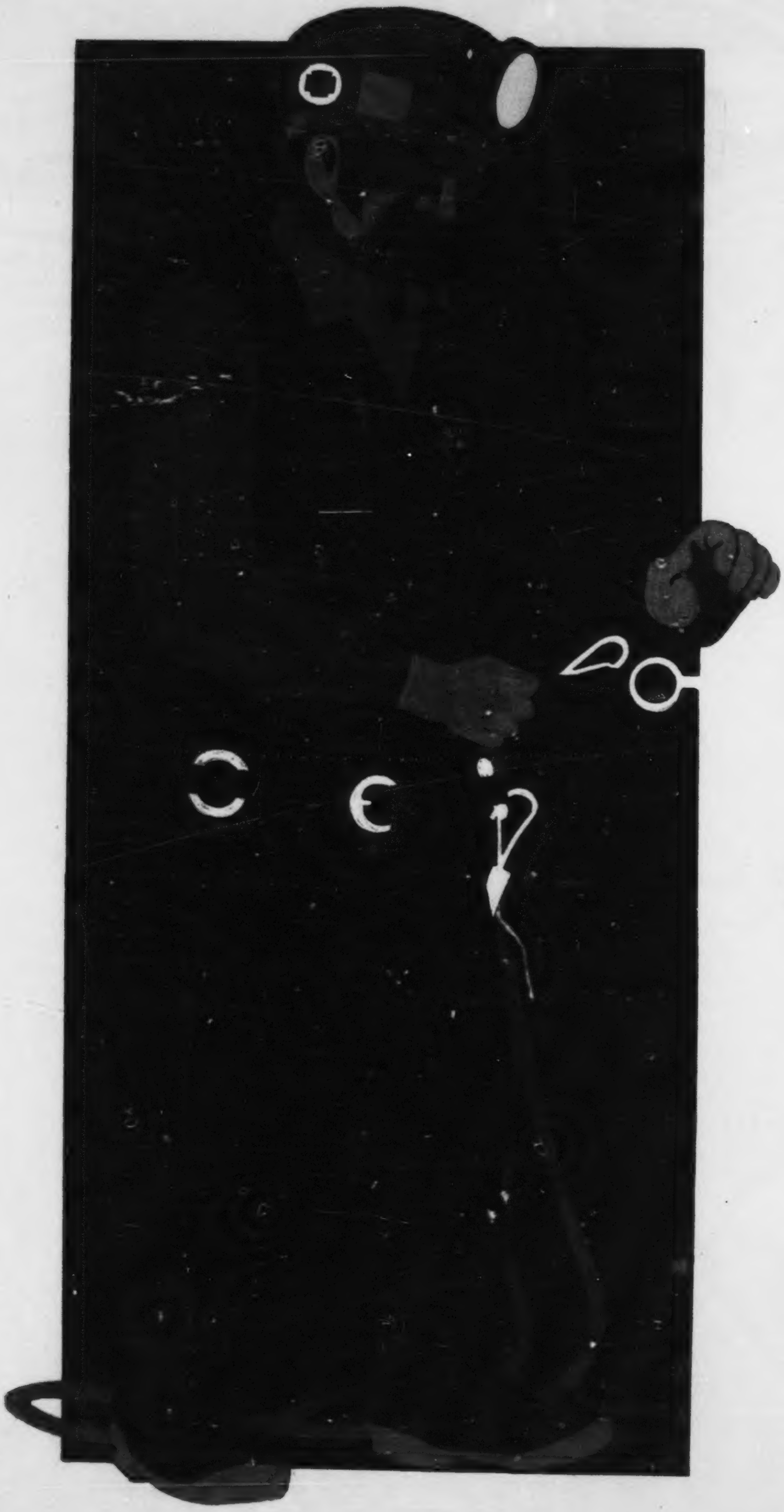
- **SM 17—Safety Tips for Underground Coal Mining,** by Daniel J. Connelly and John V. Forte, 35 pp., 19 Figs.

This safety manual presents 19 different safety tips for underground coal miners, each with a description and illustration of an actual accident that could have been prevented if the safety tips had been followed. Used in safety meetings, or as individual safety messages from the mine foreman, the safety tips can help miners recognize unsafe acts and conditions and take necessary precautions.

Lumps 'N' Chunks

Drawn by C. P. Knox

WE NEED TIMBERS DOWN HERE AND WE NEED 'EM FAST, GOPHER!
AWRIGHT, AWRIGHT! I'LL NIP A BIG STACK OF THEM TO YOU ON THIS NEXT GO-AROUND!
DARNED MINERS ALWAYS GIVE US SUPPLY GUYS A HARD TIME. WELL THIS LOAD OUGHT TO MAKE THEM HAPPY
uh oh, A DERAIL...! ...AAAHHH!!!!
IN THE DRY CHANGE ROOM ON THE SURFACE
YOU SHOULD HAVE SECURED THAT LOAD. HOW DUMB CAN YOU BE?
AWRIGHT, I DESERVE IT THIS TIME, BUT WILL YOU GUYS EVER CUT ME A BREAK?



Hook up and be SAFE

Safety Technolgy

Church

(Continued from Page 15)

MSH: *What about the rights of miners to participate in MSHA inspections? Has that provision of the Federal Mine Safety and Health Act of 1977 helped to improve safety and health conditions in UWMA mines?*

President Church: Yes. If you look at non-union mines, I don't believe it has had that great an effect as far as I can tell, but in union mines, it has been very helpful. Take the discrimination provisions for example. In our contract, miners are also protected against discrimination. I know of several cases under the 1977 Act where miners have been reinstated, and I think in UMWA mines, it has been very effective. Where you don't have a union mine, I would not think nearly as much. There, many people still are not familiar with their rights, and they also don't have anybody to back them up if they take action under the law. Now, in a union mine, if we think someone is being discriminated against over safety matters, we defend them vigorously.

Upcoming Meetings, Events

September

8-12	Mine Safety and Health Administration, short course, First Responder Emergency Medical Services, National Mine Health and Safety Academy, Beckley, W.Va. Contact Fran Rhodes, The Academy, Box 1166, Beckley, W.Va. 25801
9-11	Mine Safety and Health Administration, short course, Accident Prevention Techniques, National Mine Health and Safety Academy, Beckley, W.Va. Contact Fran Rhodes, The Academy, Box 1166, Beckley, W.Va. 25801
14-17	Coal Association of Canada, 32nd Canadian Conference on Coal, Hotel Vancouver, Vancouver, B.C. Contact The Coal Association of Canada, Suite 210, 909-5th Avenue, SW, Calgary, Alberta, Canada T2P 0J1
15-18	Mine Safety and Health Administration, short course, Occupational Health Problems in the Mining Industry, National Mine Health and Safety Academy, Beckley, W.Va. Contact Fran Rhodes, The Academy, Box 1166, Beckley, W.Va. 25801
16-20	Institution of Mining and Metallurgy, Eurotunnel '80, 2nd International Exhibition and Conference for the Tunneling Industries, Basle, Switzerland. Contact the Secretary, Institution of Mining and Metallurgy, 44 Portland Place, London W1N 4BR, England
18-27	China Coal Society, the Chinese Society of Metal, World Coal, and World Mining, First International Mine Planning and Development Symposium, Beijing and Beidaihe, China. Contact Cheryl Collins, 500 Howard St., San Francisco, Calif. 94105
21-24	American Mining Congress, Mining Convention, San Francisco, Calif. Contact Chester Truax, Suite 1100, 1200 18th St. NW, Washington, D.C. 20036

Stamp of Approval

The following equipment has been recently added to the Mine Safety and Health Administration's list of permissible or approved equipment:

- **Model Mini-Master Rockduster on Skids,** with one 5 hp, 128 volt, DC motor, issued to Industrial Pneumatic Systems, Columbus, Ohio;
- **Pump vehicle,** with one 275 hp, 950 volt AC motor, one 100 hp, 950 volt AC motor, two 40 hp, 940 volt AC motor, two 15 hp, 950 volt AC motor, issued to Continental Oil Co., Morgantown, W.Va.;
- **Longwall mining systems with one 228 hp,** two 200 hp, two 75 hp, and two 40 hp, 950 VAC motors, issued to Eickoff-American Corp., Pittsburgh, Pa.;
- **Model AMF 175/P-60 mine fan with one 69 hp,** 460 VAC motor, issued to Spendrup and Associates Inc., Grand Junction, Colo.;
- **Model 3720 roof drill with integral dust collector,** with two 30 or 40 hp motors, issued to FMC Corp., Mine Equipment Div., Fairmont, W.Va.;
- **Model 350 DC roof drill with integral dust collecting system,** with one 30 hp motor, issued to FMC Corp., Mine Equipment Div., Fairmont, W.Va.;
- **Longwall mining system with one 230 hp,** two 40 hp, and two 250 hp, 950 VAC motors, issued to Service Machine Co., Huntington, Va.;
- **Model 15CM continuous miner,** with two cutter motors, 95 or 110 hp, one gathering head motor, 40 or 50 hp, two traction motors, 15, 30, or 40 hp, and one pump motor, 35 hp, 440/550 volt, AC, issued to Joy Manufacturing Co., Franklin, Pa.;
- **Model CM285-3-3E/3EEE continuous miner with two cutter head motors,** 125 hp, two traction motors, 50 hp, two conveyor gathering head motors, 25 hp, and one pump motor, 25 hp, 440/550 volt, AC, issued to Lee Norse Co., Pittsburgh, Pa.;
- **Model Nos. 464775 and 464777 combination 30-minute pressure-demand self-contained breathing apparatus and pressure-demand Type C supplied air respirator,** issued to Mine Safety Appliances Co., Pittsburgh, Pa.;
- **Model Nos. 464776 and 464778 combination 15-minute pressure-demand self-contained breathing apparatus and pressure-demand Type C supplied-air respirator,** issued to Mine Safety Appliance Co., Pittsburgh, Pa.;
- **Model Nos. 7604L, 7604LN, 7604LS, and 7604LSN chin style gas masks,** issued to Norton Co., Research and Development, Cranston, R.I.;
- **Model No. 10303 valveless, "disposable" respirator,** issued to Pulmosan Safety Equipment Corp., Flushing, N.Y.;
- **Model Nos. 468023, 468024, and 468025 ultra-twin full facepiece,** Kwik Spray respirators, issued to Mine Safety Appliances Co., Pittsburgh, Pa.;
- **Model Nos. 468026, 468027, 468028, 468030, and 468031 belt-mounted Comfo III,** Kwik Spray respirators, issued to Mine Safety Appliances Co., Pittsburgh, Pa.;
- **Minehaul Fire-Resistant Conveyor Belt,** issued to Uniroyal Industrial Products, Division of Uniroyal Inc., Port Clinton, Ohio;

The poster on the opposite page is designed to encourage miners to observe and work toward improved safety practices. The poster, which was created by Art Director Columbus P. Knox, can be cut out of this issue and placed on bulletin boards or at other locations regularly passed by working miners.

The dynamic pressure wave resulting from the gas explosion at the Belle Isle Salt Mine hurled this Terex truck into a reclaim bin as it rolled through the mine's 1 Main Entry South.

Belle Isle

(Continued from Page 7)

Rescuers went underground three more times on Sunday morning and afternoon, but were unable to locate Sampay. A fourth effort, by the International Salt Co. team was successful, however, and, shortly after 3 p.m., Sampay's body, which had been located in the upper level shop three-fifths of a mile from where he and Olivier had detonated the scheduled blast, was hoisted to the surface through the No. 1 shaft.

After recovery of the last victim, the Belle Isle Mine was closed for extensive rehabilitation and procedures were developed for later re-entry of the mine and the formal investigation of the disaster.

The 10-month-long MSHA investigation into the causes of and circumstances surrounding the tragic explosion, culminating in the issuance of a candid report and recommendations in May 1980, was one of the most thorough and painstaking investigations of a mine disaster ever made. The investigation required thousands of meticulous examinations of specific parts of the mine and equipment components, as well as hundreds of interviews, measurements, tests and document searches.

Based on an intensive gas sampling program conducted by MSHA in the weeks following the disaster, the Belle Isle Mine and three of Louisiana's other "Five Islands" salt mines were classified as "gassy" under provisions of Federal Mandatory Standard 57.21-1, Title 30, Code of Federal Regulations. Mines determined to have flammable gas problems and classified as "gassy" are subject to special MSHA requirements including those dealing with frequency of inspections, fire prevention, ventilation, mining equipment, illumination and explosives contained in the gassy mine standards.

The Belle Isle Mine has since been able to resume production, and MSHA is continuing to work closely with the operator to assure that everything humanly possible is being done to prevent a repetition of the tragedy.

Milestones in Safety, Production, Surface and Underground Coal Mines, 1910-1979

Year	Fatalities	Production (short tons) in millions of tons
1910	2,821	501.5
1920	2,272	658
1930	2,063	536
1940	1,388	516
1950	643	562
1960	325	435
1970	260	609.8
1979	144	707.4

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U.S. Department of Labor
Mine Safety and Health
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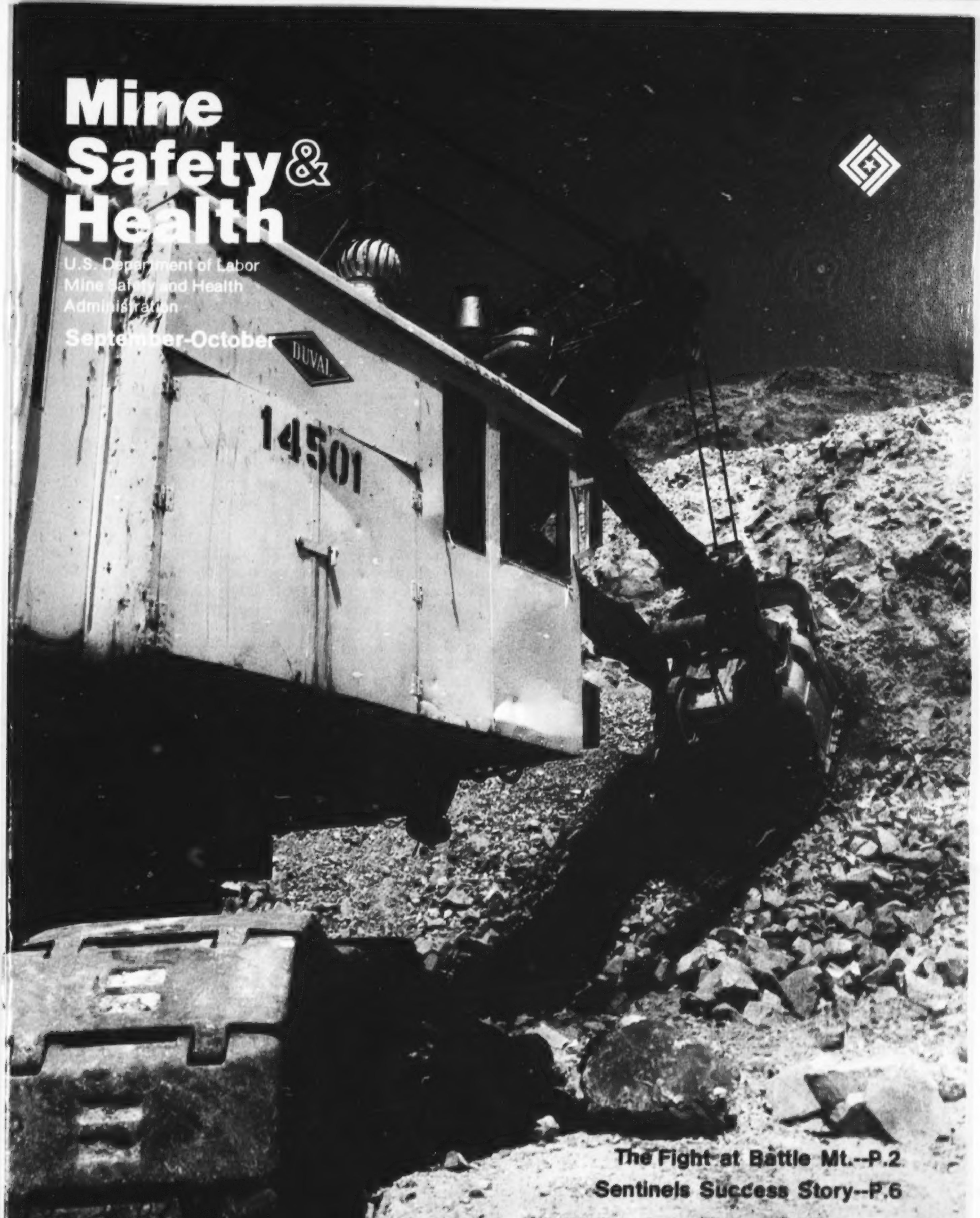
September-October



The Fight at Battle Mt.--P.2
Sentinels Success Story--P.6

Letters to the Editor

To the Editor:

I would like to compliment you on the magazine, the June issue of Mine Safety and Health, which I found interesting and informative.

In the past, I have used your publication as a source of data for our in-house safety program. Your last issue contained an article by George Dorsey entitled "New Attacks Mounted on Roof Hazards." If possible, I would like to obtain prints of some of the photographs used in the article . . . I am currently revising our "roof control" training module and these pictures and some of the information in the article would be very useful.

I also noted that Ralph E. Lewis' article documented the Sherwood Mine's excellent safety record, I hope they have been able to continue without a lost-time accident since the article was written. Coincidentally, on Aug. 13, our mine completed one full year and over 524,000 man hours without a lost-time accident and we are setting our sights on one million man hours.

It might be interesting to do an article comparing the safety records of coal and metal and nonmetal mines over the last several years. If there is a significant difference (outside of mining conditions), it could be analyzed and presented to your readers. At any rate, keep up the good work.

Yours very truly,
R. A. Kinkade, Employee Relations Manager,
Morton Salt Division of Morton Norwich.

George Meenach, safety director at the Sherwood Mine, is sorry to report that three lost time accidents have occurred in the operation's maintenance department since the article was written. One worker broke a leg when attempting to install a transmission in a haulage truck, another suffered minor burns when a carburetor backfired, and the third suffered a pinched nerve in a lifting mishap. Meenach was quick to add, however, that with renewed efforts in this area, Sherwood will have a good chance at winning the Sentinels of Safety Award for 1981. Congratulations on Morton's fine performance, and good luck in the competition.—The Editor

To the Editor:

The officers and executive committee members of the Holmes Safety Association wish to thank you for your article concerning the Holmes Safety Association and its activities in the July-August issue of Mine Safety and Health. We appreciate any effort made to introduce the Association to the mining industry; hopefully, we will reach a goal of 100 percent participation.

Yours with safety,
William H. Hoover,
Chief, Holmes Safety Association

To The Editor;

I am a mine inspector in the South Central District and a fatality occurred at one of the mine properties I inspect. A miner was fatally injured when an 18 ton haulage truck backed over him. There were several elements which contributed to the fatality, but the main one apparently was the absence of a back-up alarm on the truck.

But that is not why I decided to write this article. You probably see fatalgrams and reports like this—we get them weekly. The reason I decided to write is that after I attended the funeral of the 49 year old miner, I was so emotionally touched by the grief of the miner's daughter that I had to leave the funeral. She was about 16 or 17 years old and all during the funeral she kept crying and saying, "I want my Dad, . . . I want my Dad."

I didn't know the miner or his family but the experience hit home. I have a daughter and so do many of you. Our daughters and we are fortunate, because when one of our daughters says, "I want my Dad," we are there. This young girl's isn't. As I sat there in the church, I looked around at many of the people there, and I could see the hurt they felt for her.

All the crying and praying will not bring this girl's father back. But there is a lot we can do to prevent this from happening again. The next time the safety director, plant manager, the miners, fellow employees who were at the funeral looks at a fatalgram, I think we all, including myself, will hear that young girl saying, "I want my Dad."

The job we do as inspectors, safety directors, plant managers, supervisors, and miners in the prevention of accidents and fatalities, touches a lot more people than we think. If you don't believe me, ask the young girl.

Excel Warren, Jr.
MSHA Inspector,
Little Rock, Ark.

Mine Safety & Health

U.S. Department of Labor
Mine Safety and Health
Administration

September-October

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A shovel operator recovers copper ore from Duval Corp.'s Copper Basin pit near Battle Mountain, Nevada. The photo is by Ralph Lewis.
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United States Department of Labor
September/October 1980 issue, Volume 5, No. 5

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Expressions of opinion in articles outside the U.S. Department of Labor do not necessarily represent the views of the Department.

Change of Address: Write to Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Ray Marshall, Secretary
United States Department of Labor

Robert B. Lagather, Assistant Secretary
Mine Safety and Health

Wayne E. Veneman, Chief
MSHA, Office of Information

Samuel A. Stafford, Editor, Mine Safety and Health Magazine; Ralph E. Lewis, Assistant Editor; Columbus P. Knox, Art Director; Fred Bigio, Graphics Consultant; Sharon Maines, Editorial Clerk. Photos with article on the Battle Mountain Mine by Ralph Lewis; Photos with article on safety programs at Peabody's Dugger Mine and Bethlehem's Mine No. 108 courtesy Peabody Coal Co., and Bethlehem Mines Corp.; Photos with article on Comstock hazards by Ralph Lewis and courtesy of The Bancroft Library and the National Archives; Photos with article on highwall hazards by Keith Watson and HBAC personnel; Sentinels of Safety photo courtesy Hercules Power Co.; Truck visibility photo courtesy Bureau of Mines personnel; Photos with article on the National Metal and Nonmetal Mine Rescue Contest by Debra Howerton.

Duval Corp.'s Battle Mountain operations in Nevada won the Sentinels of Safety Award in 1978 for having the best safety record among all surface metal and nonmetal mines in the Nation that year. Pictured above is the Copper Basin pit from which about 250,000 tons of copper ore are extracted annually.

Winning the War at Battle Mountain

Firm Corporate Support Backs Successful Safety Supervisor

By Ralph Lewis
Assistant Editor, Mine Safety and Health

Lynn Holley, senior safety supervisor for Duval Corp.'s surface gold-silver and copper operations near Battle Mountain, Nev., recently recalled why he first decided to pursue a career in mine safety and health. "I saw a lot of good friends get hurt or killed when I first started, but I guess my dad, an old-fashioned Arkansas preacher, probably influenced me the most," he said.

"One day he said that I did everything his profession was against," Holley added. "I smoked and swore, he said, and of course I couldn't deny that. I told him though that while it was his business to preach and save souls, it was mine to preach and save lives. Well, he always wanted me to follow in his footsteps, and in that sense, I believe, I have tried to take after him."

If the safety record of Duval's Battle Mountain Mine is any indication, Holley's sermons have paid off. Since April 1977, an average of 310 employees there have worked more than two million hours without a lost-time injury as of this writing, and in 1978 they won the MSHA and American Mining Congress sponsored Sentinels of Safety Award for having the best safety record in the Nation among all surface metal and nonmetal mines. That year too, they received the National Safety Council's highest accolade, the Award of Honor, and in 1979, they finished second in the Sentinels contest, short of the total man hours worked by the first place recipient in that category, United States Steel's Rockland Mine in Polk Co., Fla.

"Battle Mountain's record is particularly remarkable when you consider that, like many mines today, they suffer from a fairly high employee turnover rate," said Myron Breland, an MSHA inspector based out of the agency's Reno, Nev., office. "Back in the early 1970's, they had nothing but problems up there too. Holley should get a lot of the credit for turning the place around, but you have to remember that he could not have done that without the support of management," he added.

And Holley, 49, has the support. Backed strongly by J. P. McCarty, the mine's resident manager, Holley has the authority to fire anyone on the spot—from hourly employees on up to department heads—for any failure to comply with company safety standards. He can also halt any production activities should a problem demand immediate attention, but in recent years, thanks to what he believes is a strong safety commitment among most employees, he rarely has had to wield the club. "When Holley speaks, people know he's speaking for me," McCarty said.

This apparently firm corporate safety policy is not new at Duval operations. When the company opened its Saunders underground potash mine near Carlsbad, New Mexico for production in 1951, a rash of serious injuries, many related to poor ground conditions, prompted the hiring of the company's first full time safety supervisor. Over the years, a formal safety policy evolved and the company's record improved. The biggest change came in 1967 when the mining of pillars began in sections that had been developed when the mine first opened. Subsidence had considerably weakened the ground in this area, and in anticipation of the potential hazards, management decided to overhaul the existing safety program.

After thorough evaluation, corporate officials considerably strengthened the safety supervisor's enforcement authority, giving that person the power, if need be, to dismiss any employee who was unwilling to comply with company safety standards. Among additional measures taken, cabs and canopies were fitted on all face equipment, accident prevention classes with an emphasis on ground control were held for all employees, daily safety inspections were conducted by the mine superintendent, general foreman, and safety supervisor, safety suggestions from hourly employees were encouraged and acted on, and all accidents and close calls were investigated.

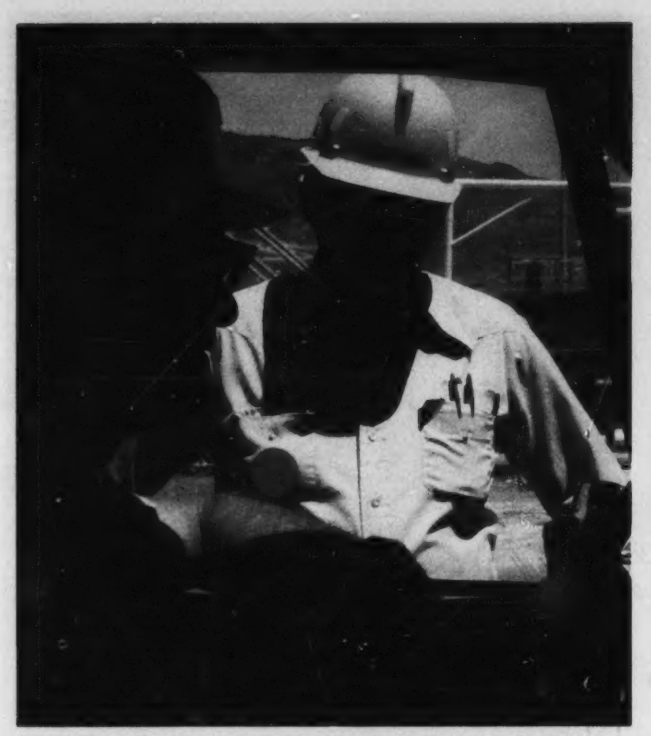
The new safety policy worked. From 1968 through 1970, Saunders employees worked over 2.3 million hours without a lost time injury, and interestingly enough, the production average for this period jumped ten percent over the preceding three years according to company officials. During that time too, Saunders employees were three time recipients of the Sentinels of Safety Award for underground nonmetal mines. But while the potash miners were patting themselves on the back for their impressive accomplishment, many Battle Mountain employees were making frequent trips into town to see the company doctor. Of Duval's ten operations at the time, the Nevada property had the worst safety record.

In August 1972, McCarty became resident manager at Battle Mountain and promptly had Holley transferred to the property from Duval's Sierrita Mine in Arizona. Backed by the corporate safety policy developed at the Saunders mine, Holley began to set the stage for drastic changes. "We had to act quick," Holley said. "When I first came up here, I had never seen a group of people with such a bad attitude. They wouldn't speak to you even if you were dying."

The second day on the job, Holley investigated an accident involving a leach plant worker who had stepped

Battle Mountain's senior safety supervisor, Lynn Holley, stands next to a trophy case at the mine's entrance. The case currently houses the Sentinels of Safety trophy and Duval's President's Trophy for the safest operation among all company mines. The Battle Mountain operation has won the President's award for three consecutive years.

A. T. Jones, manager of electrical engineering, and Ken McKinsey, electrical general foreman (left to right), go over a list of MSHA-approved power cables with Lynn Holley in the safety office. Safety activities in all mine departments are closely monitored by the safety staff.



Lynn Holley discusses a recent safety inspection with Paul Hargrove, a foreman at the operation's copper extraction plant.

Workers at Battle Mountain's gold mill pour molten gold during the last stages of ore processing.

on a misplaced pipe and was burned with acid when the pipe ruptured. "The place was a horrible mess, and I chewed out the foreman from one end to the other," Holley said. "The foreman said he had already run off several safety men, but I told him it wouldn't be me who went down the road. That month, they had already had about six disabling injuries. Since then they have had none," he added. "That foreman today can't do enough for safety, and his attitude is among the best here."

Accountability is the key, Holley believes, to any successful safety program, and at Battle Mountain, all employees are held responsible through a well structured reporting system regarding all safety meetings and inspection activities. It begins before each shift when crew members participate in 15 minute "pre-starter" meetings. Problems from the previous shift can be quickly identified at that time Holley said, and frequent reminders of common hazards help enhance safety consciousness during these sessions. A monthly record of these meetings with information on topics discussed is recorded and filed with the safety department.

Detailed reports on the hourly safety meetings held each month for shift crew members also land on Holley's desk. Of these sessions, eight are training meetings which satisfy MSHA's annual retaining requirements for all surface miners, and the remaining four involve general discussions on accident prevention and local conditions. Holley also holds monthly safety meetings for all general foremen and superintendents during which every accident, however minor, is reviewed and preventative measures are discussed.

Inspections of all mine areas are frequent, and they begin with the shift supervisor who is assigned a specific location which is thoroughly inspected at least once a month. A second monthly inspection of each department is made by both the shift supervisor and appropriate general foreman, and following both of these inspections, reports detailing conditions are submitted to the safety department. The safety staff compiles these reports into a quarterly audit which is reviewed by the mine's resident manager and Duval's vice president of corporate affairs, A.E. Smith, at company headquarters in Tucson, Arizona.

From shift supervisors on up to the corporate level then, management personnel are held accountable for safety conditions, but the responsibility doesn't end there. Under a contract with the Operating Engineers of America, union safety committeemen from each department make general inspections of all areas at least once every six weeks with Holley, and written reports of their findings are filed with the safety department. Jim Bridges, a union member who works in the mill maintenance department, said that hazardous conditions are corrected right away for the most part. "You'll have a few instances where it will be slow," he said, "but usually it is because parts are on back order or something like that."

Holley said that union participation has been especially helpful in implementing his system of "checks and balances," but he also believes that without any authority, a safety man is merely a figurehead, nothing more. "One of the biggest problems in safety today, is that the people who are held responsible for safety—your average company safety man—that's all he is, just held responsible," Holley said. "A safety man has to have the power to override production to get things fixed because if he doesn't, he will have no respect from either the hourly employees or supervisors. Without that respect, you might as well not even have a safety program. It is the same difference."

The size of Holley's staff, when measured against the physical dimensions of the Battle Mountain operation, might be considered small by some standards. Though he supervises 13 security employees and a clerk, he is assisted in his safety duties by only one other safety supervisor, G.L. Chambliss, also the mine's training

Duval Corp.'s Battle Mountain property is highly mineralized with gold, copper, molybdenum, lead-silver deposits, and even turquoise. Mined extensively since the early 1900's, the area is dotted with abandoned mines and old buildings like the one pictured above.

Lynn Holley checks a first-aid cabinet in one of the mine's maintenance facilities. The senior safety supervisor makes frequent inspections of all areas with supervisory and hourly paid personnel.

coordinator. In addition to the copper plant, gold mill and all maintenance facilities, they are responsible for covering two open pits—The Copper Basin Mine, which produces about 250,000 tons of copper ore annually, and the Tomboy Pit where roughly 450,000 tons of low grade gold ore are excavated each year. Located about eight miles apart, the pits are considered one operation since employees of both are frequently shifted between the two, depending on the immediate work requirements. Understandably, Holley and Chambliss cover a lot of territory in one day, and though they are considerably aided by the mine's radio communications network, they rely heavily on a safety program structure that provides a system of accountability throughout all levels of the workforce, Holley said.

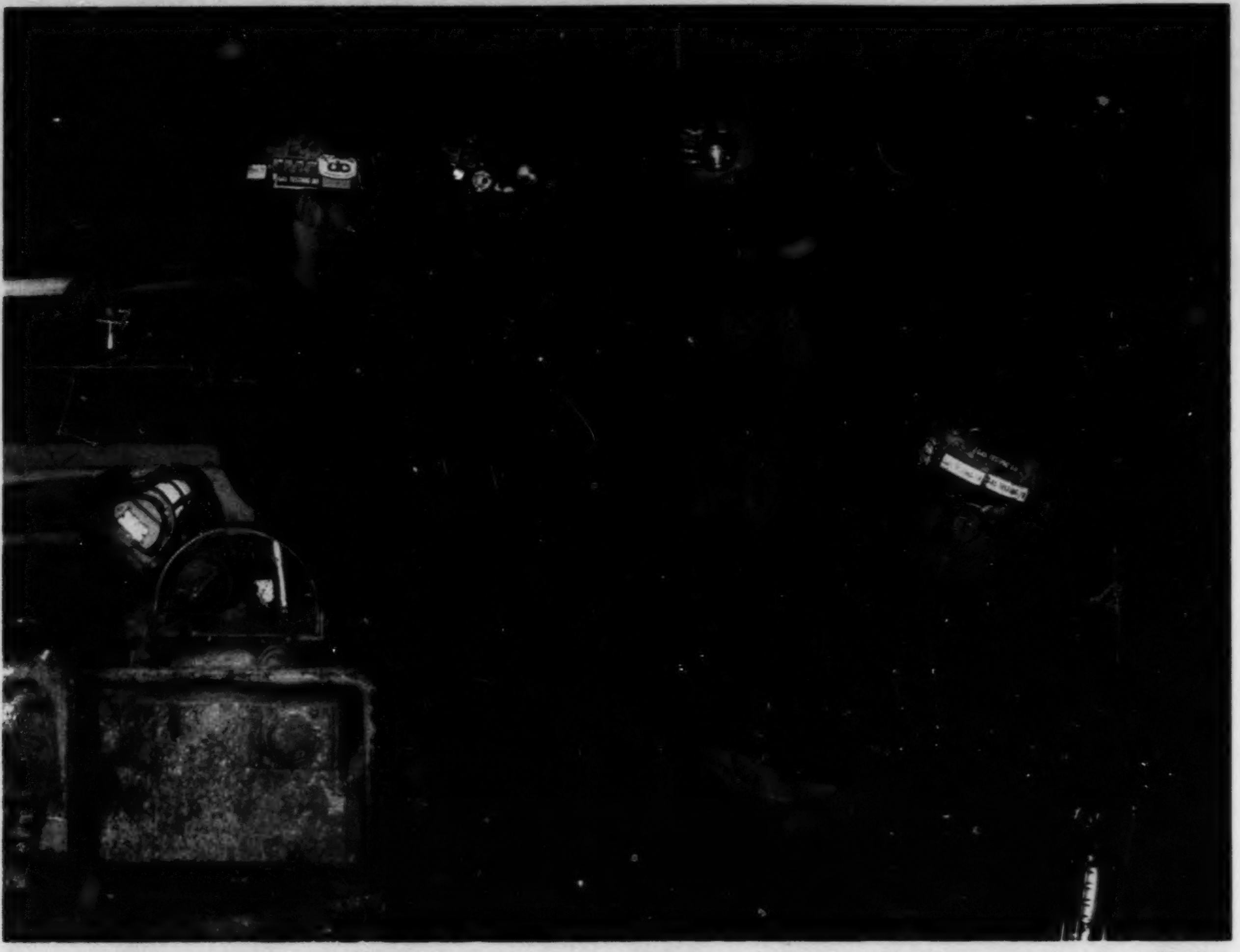
Despite his enforcement authority, Holley is apparently much less the straw boss with a whip than the fellow who commands respect simply through a fair but firm approach. "My safety philosophy? Know your people," he said. "The problem with a lot of people in management is that their title goes to their head. Regardless of what position you hold, how much money you make, the minute you think you are the least bit better than the last man you hired, well, that's when you have a real problem. You have got to be able to talk the same language that man knows," he added.

Holley said he tries to learn the first names of all employees, though the employee turnover rate sometimes makes it difficult. On his daily rounds too, in between discussions of routine business, he'll often crack a quick joke or ask a friendly question in his slow, Ozark drawl. "Over the years, I have learned that 90 percent of the time, an employee who takes chances and gets hurt will usually have his mind on something else . . . most often a serious personal problem," he said. "When I talk to people, that's why I'll ask them how things are at home, try to help them when I can. You have to have the daily personal contact to make a safety program work, and you have to be able to make that employee believe that you are sincerely interested in his wellbeing. "Attitude," he added, "is 90 percent of the game."

Jim Bridges, a ten-year Duval employee, remembers when employee morale at Battle Mountain was poor. "I had worked at other places before I came here and I suppose I took it for granted that mining was just a dangerous business," Bridges said. "Now I look back and compare, and I think we have just about the best type of safety program there is. Holley has been one of the major influences, and most people here like and respect him," he added. "He's a down-to-earth person the working man can identify with."

Both Holley and McCarty are quick to give credit to Bridges and all of his fellow employees for the mine's impressive record, however. "It comes down to a combination of things," McCarty said. "Our corporate officials demand that we place safety as our highest priority . . . our supervisors and hourly employees are extremely cooperative, we've received strong support from the union, and of course, everybody here wants to be the best," he continued. "Above all, it depends on the safety supervisor. Those people have to be able to communicate with people to the point where employees know just what the supervisor wants and expects."

Editor's Note: Since this article was written, the Battle Mountain Mine's resident manager, J. P. McCarty, has retired. His successor, Richard Sumin, has pledged continuing management support of the company's strong safety policy.



As part of the safety program at Bethlehem's Mine No. 108, a foreman conducts a "safety contact" with crew members. Each first-line foreman is required by the company to complete a certain number of planned job observations and a certain number of incidental "contacts" each month.

Sentinels of Safety Trophy Winners

Cooperation, Commitment Add Up To Worker Safety at Two Mines

By Debra Howerton
MSHA Staff Writer

Money cannot create it; training by itself cannot assure it; the most thoughtfully conceived directives cannot create it. These can and do influence mine safety, but two coal mines with nationally recognized safety records agree that safety survives in the last analysis through strong personal commitment.

Peabody Coal Company's Dugger strip mine and Bethlehem's Mine No. 108 were awarded Sentinels of Safety trophies in 1978, for being the safest surface and underground coal mines in the country that year. Winning this award has little or nothing to do with luck. It has to do with years of cultivating safety until it is as natural to a miner as digging coal.

"Safety awareness is something that has to grow," Lanny Rauer, superintendent of No. 108 in West Virginia, said. "Production comes easy to anybody, but safety is a little more difficult. Each person has to work at it." As if in reward for their effort, employees were recently informed that they are again the winners of the Sentinels of Safety trophy, making No. 108 the first underground coal mine in nearly 20 years to win the award two consecutive years.

Larry Scroggins, assistant safety manager for Peabody's Indiana Division, reaffirms that safety is a personal responsibility.

"The employees prevent accidents themselves. I can't do it for them," he said. "We establish a goal together,

Elmer K. Tenny, left, a foreman at Bethlehem's Mine No. 108, and Lanny M. Rauer, mine superintendent.

Underground at the Bethlehem operation, a continuous mining machine cuts coal from the seam and loads it onto a shuttle car.

but they work toward it. Being safe is something they must want to do." Obviously, the 140 employees of Dugger mine wanted to do it. The Indiana mine produced 577,438 tons of coal in 1978, recording 296,991 employee-hours without a single lost-time injury.

Scroggins, who several years ago established the basic program still in use at Dugger mine, believes training, open communication between management and employees, and strict adherence to federal and company safety rules—augmented by an active incentives program—combine to influence safety.

Complementing the eight-hour, MSHA-required, annual refresher training and task training for employees who switch job classifications, Safety Supervisors Ray Graham and Roy Allaway—both emergency medical technicians (EMTs)—conduct voluntary cardiac pulmonary resuscitation (CPR) and first aid classes. They have also held mandatory firefighting training for welders, electricians and key personnel working on the dragline.

The 8900 Marion Dragline, the third largest in the world, is well equipped with fire suppression equipment. To reduce the possibility of fire from grease accumulation in its numerous lower compartments, each shift is responsible for cleaning a particular section.

In the broad area of communications, foremen carry "green books" for recording weekly, individual employee "safety contacts." Also, when the safety supervisors feel it is warranted, they have the authority—with the backing of Mine Superintendent Larry Shepard—to stop production for a mass safety meeting, during which employees are informed of accident trends or other important developments. These are in addition to the required monthly meetings.

According to Graham, if the line of communication falls apart, so does the mine's safety program.

"As safety supervisors, we feel it is important that we spend as little time in this office as possible. We must have personal contact with the employees," he said. "We want them to know that they can talk to us and we will try to help them out, as long as they comply with company regulations and federal law." During any important repair job, a safety supervisor is on duty 24 hours a day, seven days a week, even if it means working 12-hour shifts.

The idea of open communication filters into every aspect of the mine's safety policy, including its incentives program.

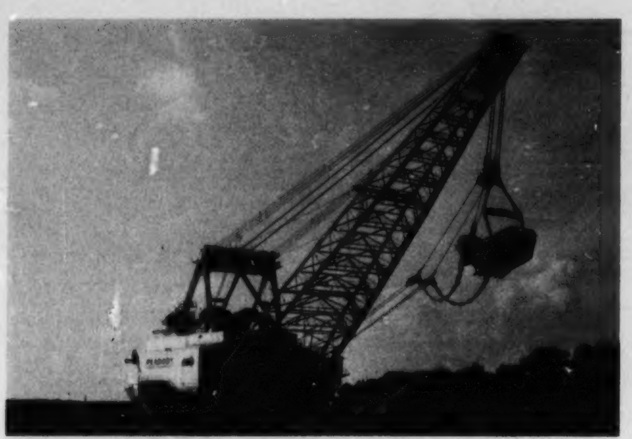
"We decided one way to increase safety awareness was to improve communications between workers and foremen, so we started a 'key word' for the month," Graham explained. "We give it to each foreman, who in turn gives it to his employees verbally." If the employee can repeat the word when contacted at home, he or she wins $25. Foremen are rewarded for their areas' safety accomplishments through a point system kept on the data recorded in their "green books." At the end of the month the foreman with the most points wins a dinner for two.

Prizes are also awarded quarterly to all employees if the mine meets its established goals. For 1980, Dugger mine aimed to reduce accidents by 40 percent in each quarter and to have no lost-time accidents. Last year, the mine experienced 17 accidents and two lost-times. Because by Aug. 1, 1980, Dugger had already recorded eight injuries and one lost-time, it is a goal toward which they have not been entirely successful.

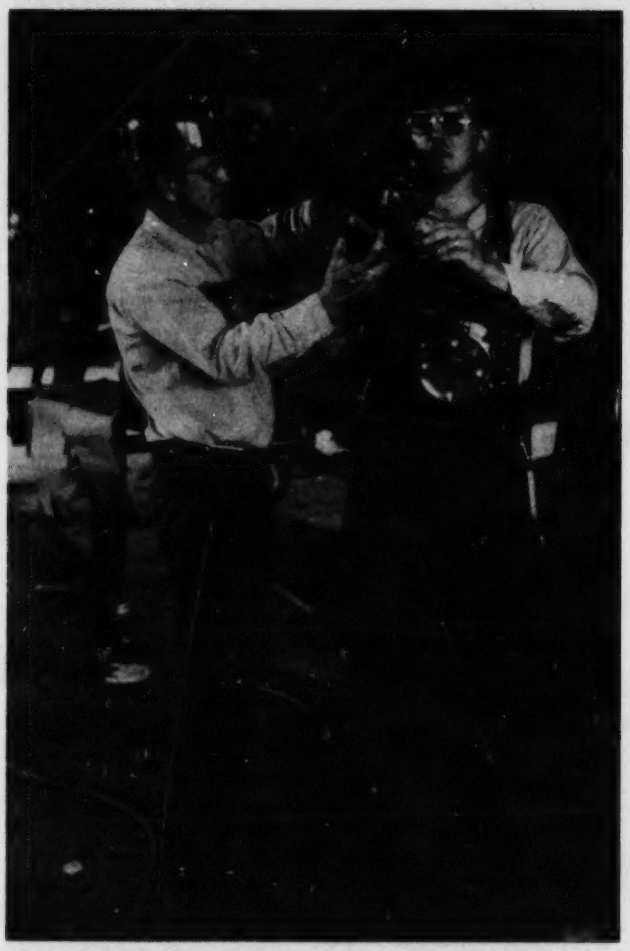
"Some of this (the decline in the safety record) I blame on the effect of the poor state of the coal industry as a whole. When employees aren't able to work more than two or three days a week, morale drops and I believe injuries are more apt to occur," Graham said. Also, the dragline has been down for repairs involving extensive welding and cutting, increasing the chances for hand injuries. In fact, 66 percent of the mine's injuries this year have involved welders. Despite apparent problems, before July's lost-time injury Dugger was Peabody's third safest surface mine, and even now it remains in the top 10, Graham said.

Working to improve communications, as well as to adhere to strict safety enforcement, management and union understand each other.

"The philosophy we practice is that when something happens, notify the safety committee. We don't hide anything from them" Graham said. "For example, if we have a problem with someone driving too fast on the property, and we speak to him but it doesn't do any good, we go to the safety committee for help. After all, they have a purpose here and they should feel a part of



Dugger Mine's 8900 Marion Dragline, the third largest in the world, has a 145 cubic yard capacity bucket. Since the mine opened in 1968, this dragline has uncovered more than 12 million tons of coal.



Kenny Bohert helps mine safety committeeman Owen Lewellyn with his bio-pack face mask during a mandatory fire-fighting course conducted for Dugger's dragline workers.

the program. We work together."

A United Mine Workers district safety coordinator also participates as an advisor during quarterly company inspections. During monthly inspections, the safety supervisors visit every section of the mine, examining every piece of equipment. Hazards or safety violations are recorded and results are given to the foremen, who must report in writing as the problems in their areas are remedied.

When accidents do occur, detailed reports are completed, including information on the victim's training and experience, and exact data on circumstances of the accident. The foreman's recommendations on prevention of similar accidents are considered, and accident analyses are made.

"We have the strictest program in the division, and it's been a tough road to hold," Graham said. "For example, we have 100 percent mandatory eyeglass protection. I've heard every excuse in the book from employees who don't want to wear them, but we bend over backwards to get glasses to fit them and, as a result, we are very successful in eye protection."

According to Scroggins, the backing of management and genuine concern for the worker are crucial to an effective safety program.

"I believe in a lot of tender loving care for the workers. I have always thought that most people have a valve, and if you can just find it and let them blow off steam and listen to them, after a while you can orient them to a safe way of thinking," he explained "There must be a mental understanding . . . a mutual agreement. We can eliminate most of the physical hazards, but the workers have to want to be safe. The key is attitude."

Dugger mine is only the surface half of the story.

Underground, at Bethlehem's Mine No. 108, approximately 200 persons worked more than 268,000 hours in 1978, extracting 423,962 tons of coal without a lost-time injury. During 1979, they added 336,960 hours to that, totaling 605,960 hours without a single lost-time injury.

Superintendent Rauer believes their consistent success is due largely to a cooperative hardline commitment to a strong safety policy, and respect for the right way to do a job, whether it be that of a laborer, a union representative, management or a federal inspector. Training, he said, is also important.

"Of course, we have MSHA's required training but we also carry out Bethlehem's own supervisory safety training program, which involves training in safety contacts, position safety orientations, planned observations and job safety analyses," Rauer said. Each first-line foreman is required to complete a certain number of planned job observations and a certain number of incidental "contacts" per month. If the employee observed is not performing his or her job properly, the foreman points out the necessary corrections and returns for a follow-up observation at a later date. Records of all observations and contacts are kept on file.

"We set standards for how each job should be done when we first opened this mine, and we stick to them," Rauer said. "It's not unusual to establish standards, but it is unusual to stick to them the way we do."

Although the mine had no lost-time accidents for two years, accidents do occur, and each one is investigated no matter how minor. Part of this process involves looking at the training record of accident victims to see if they have had the proper on-the-job training, and to make sure they have been contacted and observed by foremen. Accidents are not looked upon as isolated incidents, and with this in mind, the number of accidents occurring in each job classification is compared with the number of people working in each to get an accurate picture of accident trends. Preventive measures are the cooperative decision of mine foremen, maintenance foremen, the company mine inspector and the superintendent, who also take employees' views into consideration.

Blatant hazards discovered during a shift are corrected at once when possible. If not, the area is blocked off to prevent injuries. For housekeeping-type hazards, foremen keep an inspection checklist, turned in weekly to the mine superintendent. One of their secrets to success, Rauer said, is that a mine foreman and a shift foreman are on continuous lookout in monitoring the work areas. Nothing goes unnoticed for long.

Five-minute safety meetings are conducted each morning, and 15-minute safety meetings are held weekly, covering anything from last year's record, to current problems and accident trends.

"We also concentrate on off-the-job safety hazards, such as winter driving and hunting safety, because as far as we're concerned, whether an accident happens off the job or on the job, we've still lost an employee," Rauer explained. The mine's more than 20 first-line foremen are EMTs, and each injury victim is accompanied by one when transported to a physician.

Mine 108's safety record has drawn the attention of other mines. Recently, management and safety personnel from one company spent two days at 108 and were greeted with total cooperation.

"They had heard about our record and wanted to observe how we operate," Rauer said. "We worked with them. They were just interested in finding out why we're so successful."

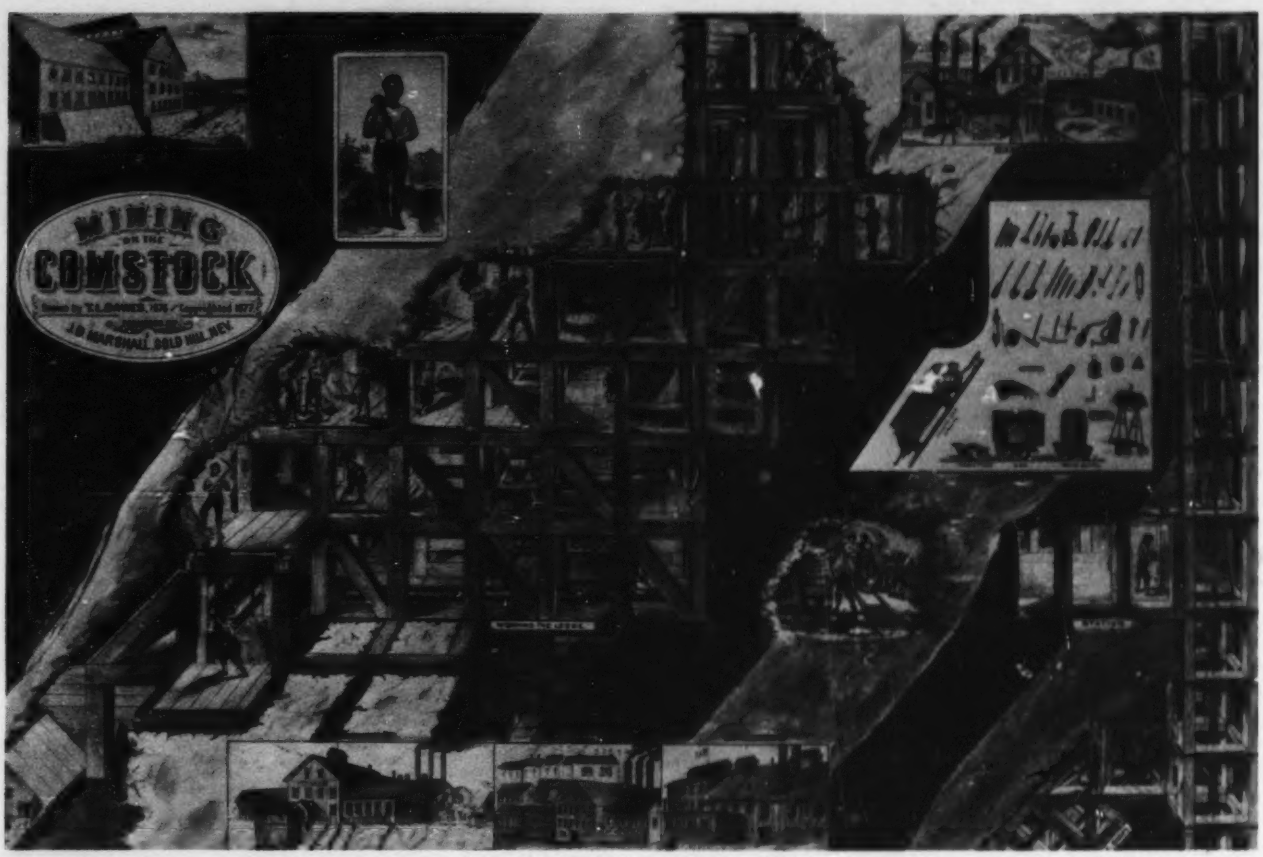
Ronald L. Keaton, manager of the MSHA district responsible for inspecting the mine, said he believes 108's success is due to the attitude of the company, the attitude of the workers toward the company, and the structure of the safety program.

"A cooperative spirit has been established between the two groups," he said. "They have the same goals and work toward them together, resulting in a commendable safety record."

"We run a strict program, and no matter how difficult it is, we can't deviate from it. We started out small enforcing our high standards, and we have continued to enforce and maintain them as we've grown," Rauer added. "If you have a safety program, you have to hold to it 100 percent of the time. There can be no exceptions."

Rex Smith lubricates a scraper, part of the routine field maintenance he performs at Dugger Mine.

A welder at the Dugger Mine repairs a gear from the huge dragline. Sixty-six percent of the mine's injuries this year have involved welders.


MINING
ON THE
COMSTOCK
J.B. MARSHALL, GOLD HILL, NEV.

The elaborate "square-set" timbering method devised by Philip Deidesheimer in 1860 to support the massive stopes of Western gold and silver mines is pictured above in this 1877 lithograph. Although capable of withstanding enormous pressures on the passageways, the timbers too often fed raging fires that claimed miners of that era.

A Hot Time on the Old Comstock

Rotten Rock, Foul Air Faced Hardrock Pioneers

The following account of the hazards of early mining in Nevada's great Comstock Lode is excerpted from Eliot Lord's Comstock Mining and Miners, *a U.S. Geological Survey history of the area first published in 1884. Though Lord himself briefly lived in Virginia City, much of the information for this chapter, entitled, "Pains and Perils of Mining," was drawn from eyewitness accounts published in the* Territorial Enterprise, *the newspaper that afforded Mark Twain his first job as a journalist. Since early issues of the paper have been lost over the years, Lord's writing provides a rare look at specific incidents in the colorful prose of his day.*

A table of accidents occurring from October 1863 through June 1880, though doubtless incomplete, shows that at least 295 miners were killed and another 606 injured during that period. Of those listed, 95 miners died in falls connected with hoisting machinery; 26 were killed by falling tools, timber and rocks; 23 were involved in heavy machinery mishaps; and 18 were crushed in cave-ins. By some estimates, the death toll may have been as high as 600.

What sort of man could endure such hardship? Due to Lord, we know that in 1880, the average Comstock miner was 36, stood about five-feet, nine-inches high, weighed 166 pounds, and made about four dollars a day. Most often, he was foreign born and unmarried. More than half of the 2,770 miners working that year in the Comstock mines and the Sutro Tunnel, were natives of Ireland or England.

Though the Comstock hardrock hand was paid well for the times, he made little effort to save. Paychecks were often squandered on gambling, stock schemes and red-eye whiskey, recognition that, for some miners, there very well could be no tomorrow.—The Editor.

Working by the dim glow of a candle, an old hardrock miner appears to be drilling a hole with hand steel in this 1867 photo taken by Timothy O'Sullivan, who used magnesium flash powder to capture one of the earliest scenes of underground mine workings ever photographed.

Of late years, heat has killed strong men in almost every deep mine on the lode, and in some mines the deaths so caused have been frequent. Thus, in Nov. 1876, a young Irishman was taken up dead in the incline of the Imperial Mine at the 1,700-foot level, and only a month later another lifeless body was found in the same level, where heat was 115 degrees Fahrenheit. Yet repeated warnings are not heeded, and often men will not realize their danger till their lives are sacrificed; for a novice to work persistently in such an atmosphere was almost surely fatal.

So when Thomas Wilson turned a deaf ear to his companions on the 2,000-foot level of the same rock furnace, who urged him to go to the cooling station, no one was surprised to see him drop his pick and fall dead at his post, March 2, 1877. Three deaths from heat within a hundred days is a significant record, but the places of the dead miners were filled before their bodies were buried. Even this record of mortality was surpassed the following year, when three men were asphyxiated by heat and foul air while climbing up a winze from the 1,900 to 1,700-foot level in the Gould and Curry Mine. A thermometer indicated that the temperature at the point where they died was 135 degrees Fahrenheit.

To lie gasping, with swollen veins and purple face, on a hot rock floor until the eyes are glazed in death is a dreadful fate, but not so agonizing as another mode of torturing by heat in the mines of the lode. The hot water which spouted from the rocks stood in deep pools at the bottom of inclines or the foot of shafts. A misstep or slip would sometimes cause men to fall into these deadly baths, from which they crawled or were dragged only to linger a few hours in hopeless misery.

So John Exley died in April 1877, having fallen into the sump of the Hale and Norcross Mine incline, then a little below the 1,900-foot level. Though the water only covered his hips, and he was immediately plucked out, the skin fell off his limbs from the knees down, and unremitting care could not save his life.

Eight months later, Michael Comerford rolled into the sump of the same incline, then 100 feet deeper, and perished miserably after one despairing effort to pull himself out by clutching at the clay-besmeared timbers above his head. Marks of his fingers in the slime were seen by the party in search of the missing man, and the ghastly, flesh-cracked corpse was dragged up from the bottom of the incline with a pole and hook. The heat of the water in this sump was then 157 degrees.

To drag a man alive from such a pool was cruelty, as was afterwards noted when William Jenkins was taken from the sump of the Julia Mine shaft, Feb. 5, 1879. Though immersed only a few seconds in the water, whose temperature was 158 degrees, he was literally flayed alive and cried for death, though his sufferings were somewhat relieved by injections of morphine.

Even if men escaped scalding and suffocation, they were exposed to another peril arising from the heat. The miners in the hot levels were subjected to most trying changes of temperatures in ascending the shafts on the swift-moving cages. The passage of two thousand feet in winter was like a magical transfer from Guiana to Spitzbergen. In three minutes men who had been sweltering naked in a stifling atmosphere might be lifted up into the chill air of bleak hills where a snowstorm was raging. As an elastic bow, if bent too suddenly, may break, so a strong man, who can endure great heat or cold, may succumb to the shock of a quick alteration from one extreme to the other.

Hence it was that men who stood shivering on the iron bars of the cage floor often felt a sudden nausea and dizziness as they were borne up the shaft. Then, if their companions did not support them with ready and strong arms, the fainting men would lose their firm grip of the bar and sink helplessly against the timbers of the shaft, to be instantly crushed by the iron sides of the cage and fall mangled to the sump. Such a fate was horrible to witness, yet so great was the speed of the cages that the victims must have died with scarcely an instant's pang, and even the agony was dulled by the existing stupor. Thus the death of a young Nova Scotia miner in the shaft of the Consolidated Imperial Mine, Dec. 12, 1876, was less painful probably than the deaths of the three miners who perished during the same fatal period of intense heat before noted, though his head, legs and arms were torn off, and the shapeless remains of a body which had been a model of manly vigor were brought to the surface in a blanket.

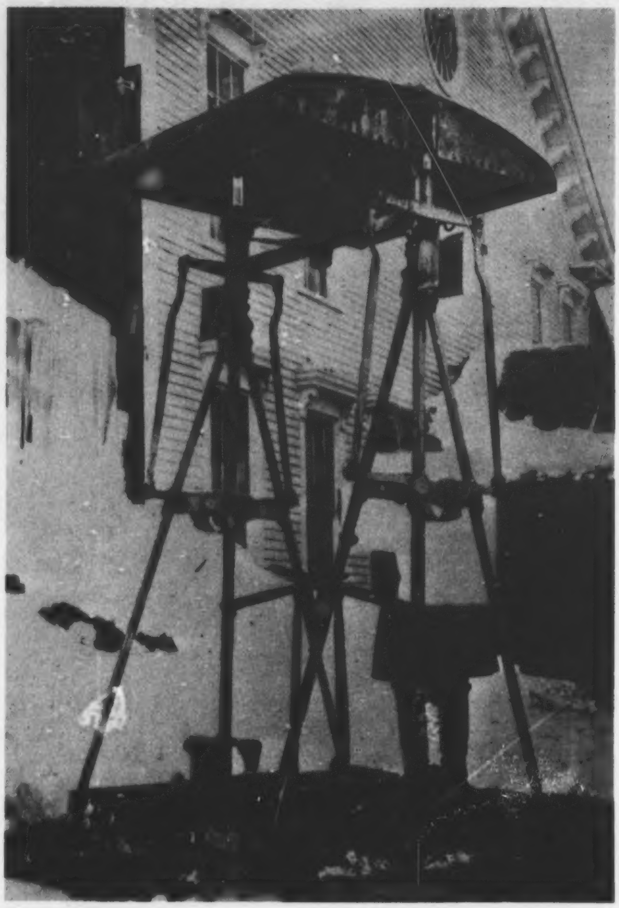
. . . Aside from the perils arising from the exceptional heat of the Comstock, it would appear also that the ordinary dangers of deep mining exist there in aggravated forms. The gangue of the lode is decomposed feldspar—a conglomerate of brittle quartz and swelling clay; hence the walls and roof of the galleries need firm buttresses of timber, and nowhere can the crumbling rock be trusted to its own cohesion without a prop. The clay seams on exposure to the air swell and separate in heavy flakes from the walls. The rotten quartz cracks under the pressure from above until the trembling roof gapes open suddenly and the passage is choked by masses of fallen rock. If men are working in the drift when the walls cave in they rarely escape with life, and the roll of deaths from this cause in the Comstock is unusually large. This disproportionate mortality has not arisen from any negligence on the part of the superintendents since the early years of the development of the lode; nor was it attributable at any time to a wretched parsimony which restricted the use of mine-timbers, but rather to the treacherous nature of the gangue and the recklessness of miners, who sometimes disregarded orders and necessary precautions.

The very perfection of the present machinery for raising and lowering the cages into the shafts has been a prolific source of danger to life. Such high speed is attained by the engines that a moment of heedlessness or indecision has often proved fatal. One careless motion of a miner in passing through the shaft may sever a leg, an arm, a head, or hurl his bleeding body from timber to timber till it drops shapeless and crushed into the hot pool at the bottom. The accumulated momentum of a body in falling from an upper level to the foot of a deep shaft is sufficient to reduce the bones to pulp if any hard substance is struck in its descent.

In July 1867, a miner weighing 180 pounds fell down the Crown Point Mine shaft, a distance of 410 feet, breaking a plank three inches in thickness as if it were a pipe-stem. The men at the lower station, where the plank extended across the shaft, could not see what substance snapped the timber. Even an iron barrier will be broken through by such a blow, as was shown in Dec. 1873, when a man dropped down the shaft of the Consolidated Virginia Mine upon a cage filled with miners, 1,200 feet below the initial point of his fall. The strong iron covering or bonnet of the cage was bent and broken, and the body of the unfortunate miner was literally crushed into pulp.

Or if an engineer fails to watch the gliding cable with keen eye, the cage may pass its destined station and plunge into the sump or be drawn violently against the sheave-frame in the hoisting works. Thus John Sinnott was crushed between a cage and the bottom of the Savage Mine shaft in Nov. 1869, so that his ankle bone was driven through the stout india-rubber boot which he wore. And, to cite one of a number of instances, the fatal accident at the Union shaft, in Dec. 1879, shows how even a careful and strictly temperate engineer may lose his presence of mind and allow a cage full of men to be drawn into the sheave.

The engineer was hoisting a cage and skip carrying seventeen men from the bottom of the shaft. As the load neared the surface he pulled the lever of the engine, intending to shut off the steam, but, strangely enough, gave a wrong turn to the lever, and the cage shot upward with a sudden bound under the increased pressure. In the effort to rectify his mistake, he blundered again in the same way, and in a moment the cage was torn out of the shaft as if shot from a catapult. Streams of fire flashed from the guides as the cage went up, and a bluish light appeared on its iron frame. The doomed men on the cage uttered no cry. One said simply, "Boys, we're gone!" just before the cage struck the gallows frame with a frightful shock. The steel-wire cable, seven inches in width and three-quarters of an inch in thickness, was snapped like twine, parting with a report "like that of a cannon." The whole building was shaken to its foundations, and some within started to run out, thinking that a boiler had exploded.



The hoisting cage shown here was probably on the surface for repairs when this photo was made in the late 1860s. The crude open cage gave little protection to occupants and was involved in a number of fatalities and serious injuries.

The iron bonnet of the cage was crushed flat by the concussion, and the men on the cage and skip were thrown sprawling over the floor of the shaft-house. Most lay senseless for a time, but soon one after another began to raise themselves upon their hands and knees with pitiful groans. Help was quickly given and the suffering men were removed, but the floor was still a ghastly sight with its stains and little pools of blood. Two miners died of their wounds before the day was ended, and six others, at least, were permanently injured. Two who clung to the shattered cage, and one who caught the bell-rope by a desperate leap, were marvelously fortunate in escaping unhurt.

To describe in detail the manifold ways in which men have lost their lives in these mines would be a needless catalogue of horrors. How dynamite and powder have exploded prematurely or tardily, striking down men under a hail of rock fragments; how cables have broken and cages fallen in the shafts; how miners have been crushed by falling timbers and buried under masses of quartz—these and other like accompaniments of mine development present no distinctive features and are most fitly recorded in a general summary.

The most noticeable effect of the high rate of mortality in the Comstock mines is the recklessness of temper and disposition toward fatalism which is thereby engendered in the miner . . . If he can do nothing to save his life, he meets his death with silent fortitude, as did a company of 17 who were dashed against the sheave at the Union shaft. He expects to die "when his time comes," but sees no advantage in dying a hundred deaths from fear before . . . A notable case in point is that of the Cornish miner who fell into the mouth of the Imperial Mine shaft, Oct. 30, 1876. The shaft was 1,300 feet deep, and those who saw him fall believed that he would be a frightfully mangled corpse in a moment.

By a combination of coolness, strength, and luck he caught hold the pump-bob nose, twenty feet below, and clung to it, dangling over the abyss until rescued. When his companions had lifted him out of the shaft he remarked, coolly, glancing down into the black depths of the great pit: "By the bloody 'ell! If I hadn't caught hold of the bob I'd 'a been scattered all abroad!" Another man might have shuddered, possibly, at this deadly peril, and murmured something like a prayer of thanks for his preservation, but the temper shown by this miner is an extreme illustration of the ordinary mode of thought among the men of his class.

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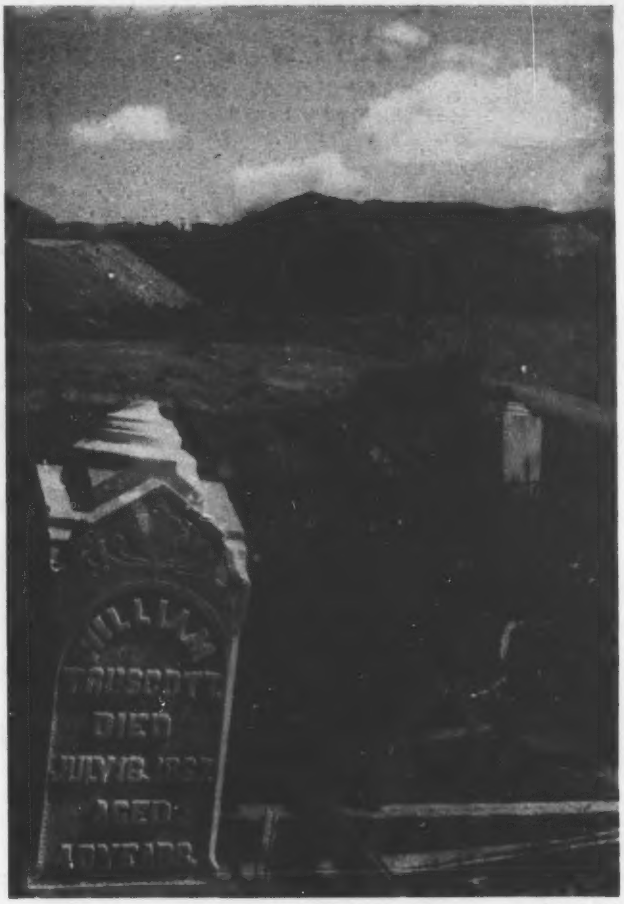
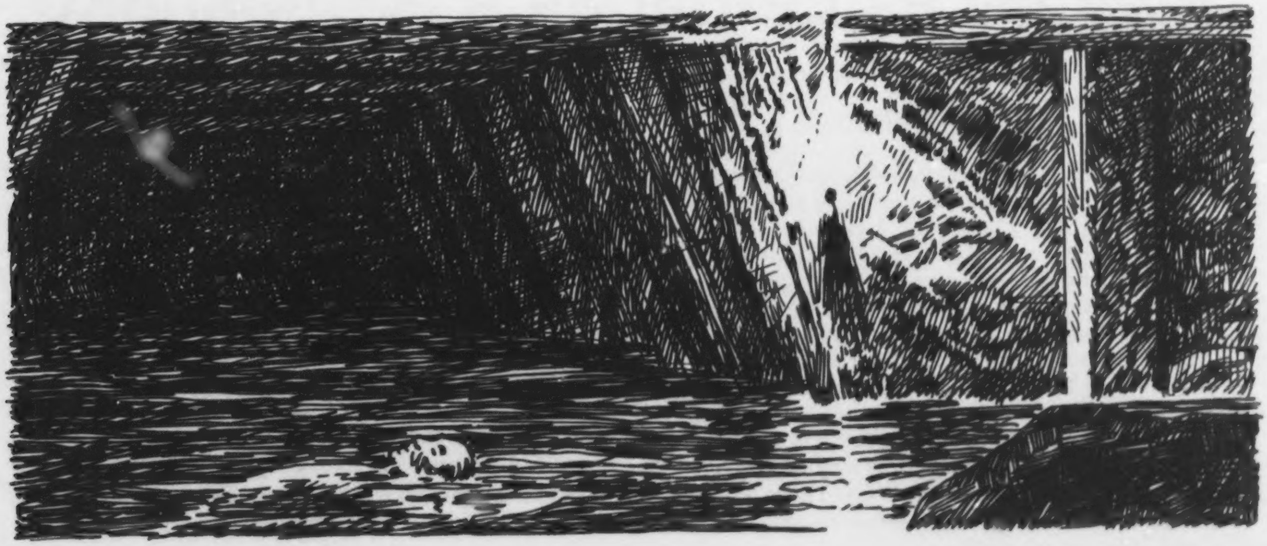
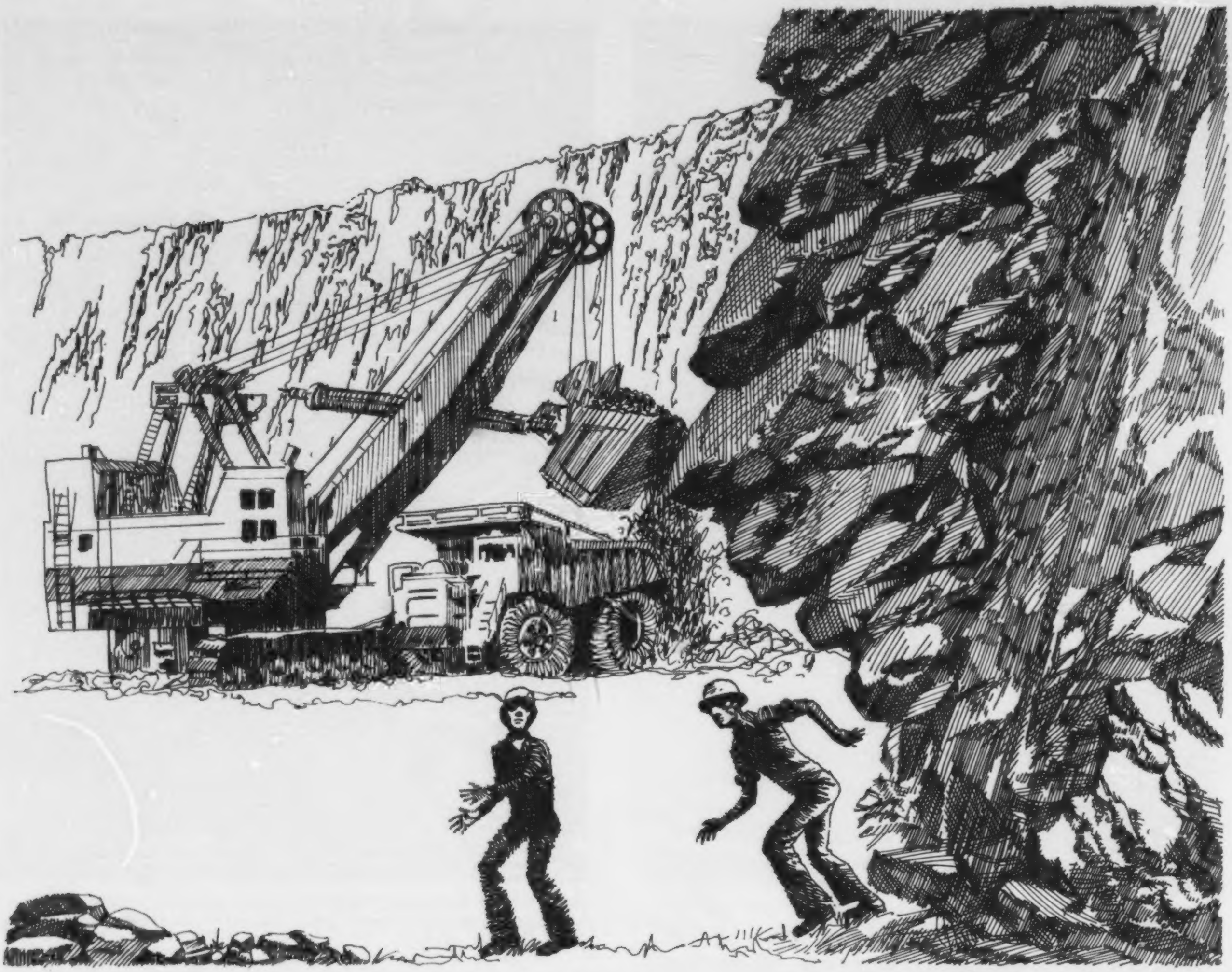


An unkempt cemetery in Gold Hill, Nev., contains graves of Cornish and Irish miners who were fatally injured in Comstock Lode mines a century ago.





Even The Safest-Looking Highwall May be as Lethal as a Rattlesnake

By Noel Milan
MSHA Staff Writer

"Heads up!" is one expression that surface miners who work near the foot of a highwall do not like to hear. That warning, shouted by a fellow miner, usually comes too late. By the time the echoes fade and the dust settles, too often another fatality or serious injury has occurred.

A study by researchers at MSHA's Health and Safety Analysis Center (HSAC) in Denver provided an evaluation of 12 fatalities associated with highwall accidents at surface mines in 1978. Ten of those occurred at metal and nonmetal operations, the other two, at coal mines. According to the study, proper pit design, the stripping of overburden back from the face, or the removal of unconsolidated material from the highwall would have prevented the falling of material into work areas in all cases.

The study also revealed that the fatal incidence rate for accidents involving the fall of material from benches or highwalls at all surface mines from 1968 through 1978 remained consistent with no statistically significant trend, and the researchers concluded that little progress had been made in reducing fatality rates for these kinds of accidents over this period. Preliminary statistics for 1979 indicate that there were at least six deaths associated with highwall accidents at surface mines—four of those at metal and nonmetal mines, the others at coal operations. Though the number of deaths in this category in 1979 was lower than in the previous year, HSAC's findings for the preceding ten years do not necessarily reflect any significant improvement the researchers concluded.

* * *

A young miner was drilling blastholes into the bench 80 feet from the toe of a 90-foot high quarry wall. A truck *driver and shovel operator, both working below the bench, saw a small rockslide on the quarry wall. Both men scrambled up the shot-rock pile to the bench where they found the driver with visible head injuries lying on the ground just ahead of the truck-mounted drill's rear wheels.*

The two men struggled to move the driller to a safer location when the truck driver saw rock falling from the wall again. He shouted to his partner, started to run and fell clear of the slide just as a falling rock knocked him from his feet. The shovel operator dove for cover under the drill rig and a large rock struck him on the hip just as he hit the ground. The driller, knocked unconscious by the first slide, now lay beneath five feet of loose rock. Rescuers were unable to save the driller's life.

Accident investigators estimated that about 8,000 tons of material fell when the wall collapsed. They concluded that the wall was weakened by a fault plane which extended through the height and width of the wall at a 40 degree angle with the surface.

* * *

Proper pit design, required before mining begins, is perhaps one of the most important safety measures that can be taken to avoid potential highwall hazards. The first step in this area coincides with the initial evaluation of mineral deposits at the mine site which includes a detailed analysis of the soil and rock to be excavated. Once an orebody or coal seam has been identified and mapped, engineers and geologists can look for planes of weakness in the form of fractures, faults or joints. Sometimes high definition aerial photographs reveal geological discontinuities, but for the most part, drill-core samples are analyzed in an effort to identify planes of weakness in the earth that may appear only after pit excavation is well under way. With the information provided by these studies, mine operators may apply the principles of rock or soil mechanics to minimize the hazards and potential financial losses posed by these weaknesses.

Once excavation begins, the slope of a pit wall is a critical factor in preventing the sloughing of loose material into working areas. The proper angle of a slope or highwall is based on several factors, including the type and nature of the material that makes up the wall, the presence of faults or joints and the susceptibility of a particular geological formation to weathering. "No near-vertical wall of material is safe for long," said George Kyler, chief of HSAC's division of special studies, "and newly cut benches and highwalls are particularly dangerous."

In some applications, particularly in open pit operations with a long life expectancy, controlled blasting techniques have added to the stability of pit walls. These methods, including line drilling, presplitting, and cushion shooting, involve drilling a row of closely spaced parallel boreholes along the final excavation line. With line drilling, the boreholes contain no explosives but create a plane of weakness allowing the blasted material to break cleanly along what will become the pit wall. The line of drill holes serves the same function as a row of perforations on a sheet of postage stamps, but in three dimensions rather than two.

The presplitting method involves a similar line of boreholes along the excavation line, but these holes are loaded with a light explosive charge and are fired just before the primary charges. The cushion blasting technique involves shooting the lightly loaded row of boreholes after the main hole pattern is blasted. These methods, often used in mountain highway construction, may add to production costs in the short run, but result in improved slope stability and miner safety over the life of the operation.

A good pit design may also employ the use of crest roads with substantial berms that can provide several ground control benefits. Well constructed berms can keep excess surface water away from face areas where it might weaken the rock or soil, and crest roads provide easy access above the face, the safest position for miners when scaling loose material. These roads also provide operators and supervisors with a clear area that can be inspected easily for cracks or other signs of slope instability.

* * *

A Kentucky surface coal miner stood at the controls of his drill rig and sunk another blasthole into the overburden at the foot of a 40-foot highwall. A small rock, 12 inches long, six-inches wide and six inches thick, apparently rolled from the top of the highwall, bounced against the drill mast, and struck the miner in the head. An end dump operator entered the pit and found the young miner on the ground. The driller died two days later in a nearby hospital.

* * *

Surface coal mine operators are required by MSHA to establish and follow a ground control plan which includes a number of specific measures the operators must take to control occasional sloughing material. Of these, spill benches are among one of the most widely used methods, and if properly maintained, they can successfully protect miners for the life of the excavation. Regular inspections of these benches allow operators to spot tension cracks which can indicate imminent slope instability, but these warning signs will only be visible when benches are regularly cleaned.

Another critical element in pit design is the height of the highwall. In contour mining, the method used to remove coal from outcropped seams in hilly terrain, the width of the bench that is cut to expose the coal will determine the height of the highwall left exposed by the cut. In some instances, operators may be tempted to widen the bench to uncover more coal, but this increases the height of the highwall, often to the point where excavators in the pit can no longer reach the top of the highwall to scale down loose material. The HSAC study of 1978 fatalities involving highwalls cited this as a significant factor in 10 of the 12 deaths.

* * *

A dozer operator at a Massachusetts sand and gravel pit failed to show up for a scheduled coffee break and was later found by a fellow worker next to his dozer, pinned by a 1,700 pound boulder. MSHA investigators

A loaded haulage truck lumbers up a grade beneath a near vertical highwall that shows signs of an earlier slope failure. The area's smooth surface indicates that a fracture or fault contributed to the failure.

A shovel operator loads coal in the shadow of an immense highwall in the Midwest. Many surface mining jobs require miners to work near the foot of a highwall where they may be exposed to the potential hazards of a rock slide or slope failure.

concluded that a temperature rise that morning from 27 to 41 degrees F. may have contributed to the failure of the pit wall.

* * *

Weather conditions often contribute to slope and highwall problems. Rainwater may seep into faults, joints and other fissures, weakening the highwall by making the exposed surfaces in the cracks slippery. Cold temperatures create additional hazards when groundwater freezes and expands in these areas. This expansion enlarges the gaps in the earth by exerting pressure against the walls of the fissure. The pressure is relieved when the rock on the exposed face of the highwall moves toward the pit, creating an even larger crack in the rock. The process is repeated when temperatures move above and below the freezing point in what is commonly called the freeze-thaw cycle, until the rock breaks free and falls into the pit.

At surface coal operations, water often collects in a pit once the coal is removed, and when a layer of clay is beneath the coal seam, a potentially dangerous situation exists. The clay absorbs the water, affecting not only the clay in the pit but also the clay that extends beneath the unmined coal and the overburden in the highwall. Since the moist clay cannot support the weight, the highwall collapses, just as if the wall had been undercut to induce caving. Pit floors should be frequently pumped or drained to prevent this condition.

In recent years, researchers have developed improved techniques to monitor ground movement in slopes and highwalls, specifically in the area of microseismic monitoring. To date, however, frequent inspections of slope and highwall conditions remain the most practical method of detecting potential hazards. Among other things, vertical or horizontal cracks that appear in a highwall face indicate planes of weakness that may portend a major slope failure. Tension cracks above a highwall may also indicate a potential collapse; ledges are particularly susceptible to weathering and may drop into the pit without warning; and highwalls that have been undercut to induce caving are especially hazardous. Equipment operators may believe that protective cabs and canopies and rollover structures will protect them from a slope failure, but they should be warned that this assumption has resulted in the deaths of several operators who were buried alive in massive slides.

"No matter how safe any highwall might appear," said Kyler, "the number of potential dangers makes them an enemy that can't be trusted. To avoid these hazards, all it takes is a 'heads up' attitude."

Trees close to the edge of this Kentucky coal mine highwall should have been removed before excavation began. When root systems are disturbed during mining, trees often break loose and fall into the pit, sometimes with fatal consequences.

Criteria Proposed for Pattern of Violations

Criteria for identifying mine operators who have a "pattern of violations" of mandatory safety or health standards recently were proposed by the Mine Safety and Health Administration.

The criteria, which the Federal Mine Safety and Health Act of 1977 authorized the Secretary of Labor to establish, would provide MSHA with a strong enforcement tool in dealing with mining operations at which there has been a serious or persistent disregard for safety and health.

The 1977 Act requires that notices be issued to operators of coal and metal and nonmetal mines having a pattern of violations of mandatory safety or health standards which could have "significantly and substantially contributed to the cause and effect of a health or safety hazard."

If an MSHA inspection reveals any such violation within 90 days after an operator has been issued a "pattern of violations" notice, MSHA must issue an order to withdraw all mine personnel from the affected area until the violation has been corrected.

Once the initial withdrawal order has been issued, each successive violation which could significantly and substantially contribute to the cause and effect of a health or safety hazard would result in the issuance of another withdrawal order. MSHA would declare the pattern of violations terminated only after an inspection of the entire mine revealed no "significant and substantial" violations. If the pattern were to be reestablished, however, the sequence for issuing withdrawal orders would begin again.

The criteria, published as a proposed rule in the August 15, 1980 *Federal Register*, are intended to be flexible to ensure that a mere statistical record of violations alone would not determine a "pattern" mine.

The size and type of mine, its number of inspection days, and its injury, illness and fatality incidence rates, as well as evidence of the operator's efforts to promote safety and health at the mine, all would be taken into account. This information would be reviewed as often as necessary, but at least once each year. To allow for comparison and to identify trends, the data would be examined in "review periods"—units of at least three months for underground mines and six months for surface mines.

An initial screening process would identify those mines that might be developing a pattern of violations, and MSHA could alert the operators and miners' representatives at these mines that a "pattern" notice might be issued unless the mine's compliance record improves. A three-person review committee would be named in each MSHA coal and metal/nonmetal mine safety and health district to examine the selected mines' inspection reports and accident, injury and illness reports. The committee would study each selected mine's history and overall safety and health conditions before preparing detailed recommendations to the appropriate MSHA district managers.

A pattern of violations would usually be indicated by one or more of the following:

—an excessive number of violations, compared to those of other mines of a similar size and type;

—an excessive number of violations of the same standard or related standards;

—little improvement or a worsening trend in overall health and safety conditions;

—little or no improvement in the safety and health record at the mine after other enforcement efforts have been tried;

—a clear history of an excessive number of accidents, injuries, illnesses and fatalities, both actual and potential; and

—poor safety and health practices or a demonstrated lack of commitment to protecting the miners' safety and health.

If, based on the district review committee's recommendation, the MSHA district manager were to make a preliminary determination that a pattern of violations exists at a particular mine, its operator and miners' representative would be informed in writing of MSHA's intent to issue a pattern of violations notice. The letter would explain the basis for the determination and give the recipients 15 days to review MSHA's documentary evidence, to submit additional information, or to request an informal conference with the district manager.

Following the conference and a review of any additional material provided, the district manager would either issue a "pattern" notice to the operator or inform him that no notice would be issued at that time. If within 15 days of the preliminary determination, neither the operator nor the miners' representative were to ask to review the documents, submit additional information, or hold a conference, MSHA would issue a pattern of violations notice to the operator.

The proposed criteria are intended to ensure that identifying mines with a pattern of violations would be a judicious yet flexible process, which MSHA would initiate only when the operator has not responded to other efforts to improve safety and health conditions in the mine.

"The pattern of violations notice is a rigorous enforcement tool given us by Congress," said Vernon Denton, MSHA Metal and Nonmetal Mine Safety and Health, "and application of these criteria would ensure that we use it fairly."

Interested persons may submit written comments to the Department of Labor, Mine Safety and Health Administration, Office of Standards, Regulations, and Variances, 4015 Wilson Boulevard, Arlington, Va. 22203. The deadline for comment is October 14, 1980.

Focus

Bethlehem, St. Joe Win 1979 Trophies of Sentinels of Safety

Winners have been announced in the annual Sentinels of Safety awards program sponsored by MSHA and the American Mining Congress. Six mines were recognized for achieving outstanding safety records in 1979.

Two sand and gravel operations received awards for similar achievements in a separate program sponsored solely by MSHA.

Both competitions honored mining establishments in various operational categories for compiling the most employee-hours without a work injury that resulted in a lost workday.

Top-ranking mines in the 1979 Sentinels of Safety program were: Bethlehem Mines Corp.'s No. 108 Underground, Upshur County, W. Va. (Underground Coal); Amax Coal Co.'s Sun Spot Mine, Fulton County, Ill. (Surface Coal); St. Joe Lead Co.'s Brushy Creek Mine, Reynold County, Mo. (Underground Metal); United States Gypsum Co.'s Sperry Mine, Ellis County, Iowa (Underground Nonmetal); USS Agri-Chemical's Rockland Mine, Polk County, Fla. (Open Pit); and United States Steel Corp.'s Cedarville Quarry, Mackinac County, Mich. (Quarry).

Each of the six mines will receive a bronze trophy and a green and white Sentinels of Safety Flag, provided by the American Mining Congress. In addition, their employees will be given individual certificates of accomplishment in safety.

First-place finishers in MSHA's Sand and Gravel Safety Awards were: Flintkote Stone Products Co.'s White Marsh Plant, Baltimore County, Md. (Open Pit); and Lone Star Industries' Dolen Dredge, Lampasa County, Texas (Dredge). Each workers at these operations will receive an individual certificate of accomplishment in safety.

Rules for the two competitions are essentially the same. Participants are mining operations subject to inspection by MSHA and are required by the Federal Mine Safety and Health Act of 1977 to report injury and employment data. To be eligible for an award, mines must report employment data for each period of active operation in the year and must accumulate at least 30,000 employee-hours without an injury resulting in a lost workday. Employee-hours and injuries at independent shops, offices, and processing plants are excluded from the totals.

Under the programs' rules, MSHA identifies mines potentially eligible for awards and asks the operators to verify their employment and injury data as recorded in the agency's files. All mining operations verified as meeting the requirements are awarded certificates of achivement in safety. A total of 661 mining establishments were thus honored for injury-free operation in 1979.

First sponsored by the U.S. Bureau of Mines and *Explosives Engineer* magazine, the Sentinels of Safety competition has presented awards annually since 1925. The MSHA Sand and Gravel Safety Awards began in 1965.

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Following are the top five operations in each category of both Sentinels of Safety competitions, with the number of employee-hours reported without a lost-workday injury:

SENTINELS OF SAFETY

Underground Mines

1. No. 108 Underground, Bethlehem Mines Corp., Upshur County, W. Va.—336,960 hours. (Ranked first in 1978 also.)
2. Mine No. 2-A, Benham Coal, Inc., Harlan County, Ky.—199,216 hours.
3. Solar No. 9 Underground, Solar Fuel Co., Somerset County, Pa.—109,664 hours.
4. A Four Mine, Eastern Coal Corp., Pike County, Ky.—109,362 hours.
5. Belmon Division No. 3, Bow Valley Coal Resources, Harlan County, Ky.—107,032 hours.

Surface Coal

1. Sun Spot Strip Mine, Amax Coal Co., Fulton County, Ill.—478,898 hours.
2. Mentmore Mine, Carbon Coal Co., McKinley County, N.M.—208,768 hours.
3. Mahoning Valley No. 33, Consolidation Coal Co., Harrison County, Ohio—187,842 hours.
4. Prater Creek Strip, Triple Elkhorn Mining Co., Morgan County, Ky.—186,199 hours.
5. Rice No. 6, R&F Coal Co., Jefferson County, Ohio—178,958 hours.

Metal Underground

1. Brushy Creek Mine, St. Joe Lead Co., Reynold County, Mo.—250,345 hours.

2. Fletcher Underground, St. Joe Lead Co., Reynold County, Mo.—229,536 hours.
3. Deremo-Snyder Underground, Union Carbide Corp., San Miguel County, Colo.—215,279 hours. (Ranked first in 1974.)
4. Indian Creek Mine, St. Joe Lead Co., Washington County, Mo.—183,632 hours. (Ranked first in 1973.)
5. Viburnum No. 29 Mine, St. Joe Lead Co., Washington County, Mo.—155,532 hours.

Nonmetal Underground

1. Sperry Mine United States Gypsum Co., Ellis County, Iowa—112,769 hours. (Ranked first in 1978.)
2. Shoals Mine, United States Gypsum Co., Matin County, Ind.—74,489 hours. (Ranked first in 1977.)
3. Alton Mine, Mississippi Lime Co., Madison County, Ill.—73,293 hours.
4. Shoals Mine, National Gypsum Co., Martin County, Ind. —69,408 hours.
5. Deckers Creek Mine, Marquette Co., Grundy County W. Va.—67,867 hours.

Metal/Nonmetal Open Pit

1. Rockland Mine, USS Agri-Chemical, Polk County, Fla.—505,479 hours.
2. Copper Canyon, Duval Corp., Lander County, Nev.—393,902 hours. (Ranked first in 1978.)
3. Reynold Surface Mine, Reynolds Metal Co., Saline County, Ariz.—320,114 hours.
4. Fort Meade Mine, Mobil Chemical Corp., Polk County, Fla.—296,470 hours. (Ranked first in 1976.)
5. Pitch Mine, Homestake Mining Co., Saguache County, Colo.—178,299 hours.

Quarry

1. Cedarville Quarry, United States Steel Corp., Mackinac County, Mich.—173,251 hours.
2. Fort Myers Quarry, Florida Rock Industries, Inc., Lee County, Fla.—172,236 hours.
3. Jamesville Quarry, Allied Chemical Corp., Onondaga County, N.Y.—163,024 hours. (Ranked first in 1974, 1975, and 1978.)
4. Frederick Quarry, Flinkote Stone Products Co., Frederick County, Md.—161,885 hours.
5. Drummond Island Quarry, Drummond Dolomite, Inc., Chippewa County, Mich.—130,240 hours.

MSHA SAND AND GRAVEL SAFETY AWARDS

Open Pit

1. White Marsh Plant, Flinkote Stone Products Co., Baltimore County, Md.—178,255 hours.
2. Senter Mine, Becker Sand and Gravel Co., Hartnett County, N.C.—137,267 hours.
3. Kingsland Plant, Lone Star Industries, Inc., Chesterfield County, Va.—105,245 hours. (Ranked first in 1974 and 1975.)
4. Park Road Pit & Plant, Acme Concrete Co., Spokane, Wash.—105,111 hours.
5. Crystal Lake-Yard 498, Vulcan Materials Co., McHenry County, Ill.—103,752 hours.

Dredge

1. Dolen Dredge, Lone Star Industries, Inc., Lampasa County, Texas—153,941 hours. (Ranked first in 1975.)
2. Ortona Dredge, E. R. Jahna Industries, Inc., Glades County, Fla.—107,660 hours. (Ranked first in 1978.)
3. Longleaf Dredge, Gifford Hill & Co., Rapides Parish, La. —92,317 hours.
4. Dredge and Plant 34, Lone Star Industries, Inc., Colorado County, Texas—84,715 hours.
5. Dixie Sand and Gravel Dredge, Dixie Sand and Gravel Co., Hamilton County, Tenn.—74,940 hours.

Radiation Dosimeters Undergo Extensive Tests

The final report has been released on a 16-month series of tests to evaluate the performance and reliability of three types of personal radon daughter dosimeters in active underground uranium mines. Performed by Southwest Research Institute under a Bureau of Mines contract, the program was the first systematic, underground testing of the thermoluminescent dosimeter (TLD), the electronic dosimeter (ED) and the nuclear track detector (NTD).

Six separate tests were conducted under a wide range of environmental conditions in Colorado, New Mexico and Utah mines with either wet, humid or dry mine atmospheres. Three of the mines used diesel equipment exclusively, two others used some diesel, and the remaining two none at all.

Development of a workable radiation dosimeter that can be worn by miners is being stressed because of concern over widespread problems with accuracy of area samples for personal exposure measurement and recordkeeping. Aware of the need for better protection of uranium miners against lung cancer, the Mine Safety and Health Administration (MSHA) continues to concentrate on enforcing its four "working level months" (WLM) per year exposure limit, while closely monitoring Bureau of Mines research projects involving radiation exposure monitoring instruments and systems, and radiation control technology.

According to Robert Droullard, the Bureau's technical project officer for the tests, while results were not definitive in proving that one particular method will be adopted, much was discovered as to their durability under actual mining conditions.

"The problem is not the dosimeters, but the mine environment. The dosimeters work accurately in a laboratory," he said. "But you splash mud and water on them day after day and they can't take that abuse. The measurement we're trying to get is very delicate."

Current methods for measuring miner exposure to airborne radon daughter products involve random "grab sample" measurements taken periodically throughout the mine and treated as average exposure levels for the affected miners. Because working levels vary significantly with time and location in the mine, it is clear that miner exposures are not always accurate. An effective personal dosimeter would be able to measure each miner's actual exposure to radon daughters.

Of the three types tested, the TLD was the most consistently reliable. This dosimeter collects radon daughter products on filter paper using a calibrated mechanical air pump. Disadvantages of the system, designed to measure cumulative exposures of up to one month, are its high cost, its size and weight, and its need for constant air flow.

"The tests showed that the TLD will work with the provision that we get better air pumps," Droullard said. "We (the Bureau's Denver Research Center) are seeking a commercial source of a reliable pump. It's possible that a source will be made available by Fiscal Year '81."

The 14 failures of TLD air pumps during the tests were caused primarily by problems with pressure switches and related plumbing, valves, batteries and battery wiring and connectors. However, the failures were infrequent and varied enough that no patterns or trends were established. Required maintenance was minimal, and the report stated that most of the system's problems appeared easily correctable with moderate cost and effort.

"There have been problems with air pumps since this research began 10 years ago," Max Slade, MSHA metal and nonmetal health specialist, said. "It's difficult to find an air-moving device that can stand up under mine conditions for extended periods of time. They'll solve the problems. It's just a matter of a little more time."

The electronic dosimeter (ED), also an active system requiring an air pump, is designed for cumulative exposure measurements covering one working shift. In this device, radon daughter products are collected on filter paper. Both the caplamp-powered and internal battery-powered versions of the system experienced major problems during the initial test and were discontinued after the first two days. Although redesign of the system improved its performance for the remaining five tests, its high cost, inconvenient weight and bulk, and required maintenance and daily processing make it less desirable for enforcement purposes at this time.

The nuclear track detector (NTD) measures alpha activity from radon and its daughter products in ventilation air in its immediate vicinity through chemical changes in plastic film, and it does not require an air pump. Like the TLD, the NTD is designed to measure cumulative exposures of up to one month. While it physically survived the two tests in which it participated, the NTD suffered such substantial damage from dirt accumulation and scratching that its exposure measurements were rendered invalid. In the final test, conducted in the cleaner environment of Carlsbad Caverns for comparison purposes, a second version of the NTD yielded reasonable results. But the report stated that in the harsher environment of a uranium mine, the altered version would probably be no more successful than the original.

"It appears doubtful that we can get the nuclear track detector to work in mine conditions, but we haven't given up," Droullard said. The University of San Francisco is researching the system under an ongoing Bureau of Mines contract, while at the same time the Bureau is working with two commercial sources of the NTD to develop and test other passive dosimeters. According to Droullard, nuclear track detectors were recently used in copper and lead zinc mines in Poland with good results.

"This spurred us on. The system is small and much less expensive than the others. If we can protect it from water and scratching, it will work," he said.

In addition to their technical results, the tests revealed significant insight into miners' attitudes toward the dosimeters.

"They were very cooperative. It's not true that miners don't care. They were all concerned about their health and accepted the equipment without complaining," Droullard said. "In fact, there were instances when miners spent their own time trying to repair test units which had been damaged."

Although the tests were successful in demonstrating the durability and performance of the dosimeters under mine conditions, Slade said there is still no firm evidence upon which to develop a federal regulation requiring their use.

"There's nothing conclusive at this point. We will have to review the test results much more thoroughly before we can tell whether they helped or hindered the standard-setting process," he explained.

"Cost is just one of the factors which must be considered in establishing a realistic standard. What we do must be based on the soundest technical knowledge."

Cooperative Effort Achieves Gains in Coal Mine Lighting

Compliance with Federal coal mine lighting standards has significantly improved due to changes in mine lighting and light measurement requirements resulting from the findings of a joint survey by industry, labor, and Government representatives last year.

Representatives of the United Mineworkers of America (UMWA), Bituminous Coal Operators Association (BCOA), and the Mine Safety and Health Administration surveyed mines of both high and low coal seams to investigate complaints of glare caused by machine-mounted lighting systems.

"Operators had received complaints from miners about glare, and we received complaints from operators about their inability to obtain and maintain suitable lighting systems," Cecil Lester, MSHA coal mine specialist, said.

The representatives visited 14 sections with coal seam heights of from 26 to 42 inches at 11 mines in three states. They observed lighting systems on 24 machines and questioned 57 miners. In a separate survey, conducted in seam heights of 42 inches to nine feet, the representatives visited 18 continuous miner sections and one longwall unit at 11 mines in five states. Lighting systems on 36 machines were observed and 102 miners were questioned.

According to the findings, 63 percent of the miners interviewed in low coal sections wanted the systems removed, while only seven percent of those interviewed in high coal wanted the lighting systems removed. However, the majority of all miners requested that some changes be made in the systems.

The number of dissatisfied miners operating on or near equipment having lighting systems clearly indicates that complying with the illumination regulations is much more difficult in seam heights of less than 42 inches, the final report said.

For electricians, maintenance foremen, mechanics and other industry personnel involved in installation and maintenance of lighting hardware in underground mines, the committee recently sponsored a series of seminars in eight cities in coal-producing regions of the country.

"This was the best transfer of technology we've had," Bill Lewis, of the Bureau of Mines, said. "It was well organized, well presented and well received." The seminars outlined the findings of the committee, and discussed MSHA enforcement policy, including changes based on committee recommendations.

The MSHA Statements of Test and Evaluation (STE) program was explained, and problems of lighting system design, installation, maintenance and economics were addressed. Eighty-five percent of the 722 attendees agreed to fill out questionnaires, the majority of which reflected favorable response to the seminars, and particularly to the joint work of the committee, Lewis said.

Based on the committee's recommendations for policy changes MSHA agreed that, to reduce objectionable glare caused by certain lighting systems in coal seams of less than 42 inches, the area in which light measurements are made must be reduced to not more than five feet from the machine. MSHA also specified other locations in which light measurements are not to be taken.

"The intent of this policy change is not to allow a reduction in the number of light fixtures used, but to permit better location, diffusing and guarding as a method of reducing or eliminating discomfort glare," Lester explained.

In response to another miner complaint that glare was created by the right rear light on remotely controlled continuous miners, MSHA eliminated the requirement for light measurements in this area. Also, because of the hazard which glare creates in the use of auger-type continuous miners and bottom-cutting machines, illumination is not required for these machines, pending development of safe, glare-free systems.

Other changes addressed problems in lighting working places where scoops are used as loading machines, areas required to be lighted when the seam height does not permit installation of light fixtures on top of these vehicles, and surfaces from which measurements may be taken when roof bolting machines are operated in low coal. Finally, in longwall mining installations in coal seams of less than 42 inches MSHA determined that because of difficulty in casting light from the chocks to the face conveyor and coal face, enforcement policy would be changed to require light measurements only along the travelway and the area within five feet from the control station and the headpiece and tailpiece.

These adjusted requirements generally have been welcomed by mine operators and lighting system manufacturers, and the cooperative effort responsible for the changes was a significant step toward resolving the widespread controversy over illumination. With the go-ahead from MSHA, manufacturers have begun to equip lighting fixtures with movable shields, tape coverings, spray coatings and other devices to control glare.

According to George Svilar, manager of MSHA's St. Clairsville, Ohio, coal mine safety and health subdistrict office, 80 percent of the mines under his jurisdiction are 100 percent illuminated, in contrast with a near-zero compliance rate one year ago. In MSHA's Johnstown, Pa., subdistrict, District 2 Manager Donald Huntley reported a 95.6 percent compliance rate, and Ronald Keaton of MSHA's District 3 in Morgantown, W.Va., reported a 98 percent compliance rate for the district, compared to about 60 percent compliance last year.

"We've been pushing lighting compliance ever since the standards were put into effect," Svilar said, "but there's no question that some of the policy changes have expedited it."

Further technological changes are in process. While progress has been made, Bureau of Mines' researchers continue to work toward improved lighting of the miners' working environment, with the objective of reducing accidents and injuries.

Lewis said the current emphasis of the Bureau's underground coal mine illumination research is: demonstration of various systems' design, installation and reliability; factory integration of the systems by manufacturers, to relieve operators from constant retrofitting of existing equipment; and extensive hardware development.

Future research, recommended by the joint health and safety illumination committee, includes: psychophysical investigation, or glare incidence and effect studies, on a sample population of miners, development of low-glare lighting systems, and promulgation of maintenance guidelines and a consolidated mine illumination reference handbook. The projects will be funded and initiated this year.

"It's a rare occasion when all facets of the mining community—business, labor and government—work together cooperatively toward a common goal," Lewis said. "This can only benefit the mining community."

Legal Briefs in Mining

Secretary of Labor v. Superior Sand and Gravel, Inc., U.S. District Court for the Western District of Michigan, Docket No. M80-2 CA2, decided May 27, 1980.

The operator of a sand and gravel mine denied entry to a MSHA inspector, claiming that the inspector was not qualified to inspect the property because he lacked experience in this particular type of mining. The Secretary sought a preliminary injunction that would prohibit the operator from denying entry.

Update

The operator said that the Secretary had not given due consideration to the experience of the inspector when the inspector was assigned to this particular duty. Though he did not dispute that the inspector was an authorized representative of the Secretary, the operator argued that Section 303(d) of the 1977 Act pertaining to the qualifications criteria for mine inspectors, amended Section 103(a) of the Act regarding the inspector's right of entry.

Federal District Judge Douglas W. Hillman ruled that Section 303(d) of the Act did not amend Section 103(a) in such a way that authorized representatives of the Secretary had to have experience in a particular kind of mining before they could inspect mines with similar mining conditions. Noting that the operator had failed to produce any evidence that the Secretary had failed to abide by Section 303(d), the judge also said that mine operators are not injured by permitting inspections by persons who do not have experience in similar types of mines because should any injury occur, it would result from a citation which could be appealed under provisions of the Act. The judge granted the injunction.

Secretary of Labor v. Island Creek Coal Co., FMSHRC Docket No. BARB 76-297-P, decided July 9, 1980.

Following a fatal accident in 1975, Island Creek was issued a citation for a violation, but the MSHA inspector failed to indicate on the notice that it was being issued as a result of a fatality. MSHA's Office of Assessments assessed the company $78 following a conference with the operator, based on the premise that the violation was a non-fatal infraction. When the mistake was discovered two weeks later, MSHA repudiated the agreement and asked a new assessment of $5,000. Island Creek said that MSHA was bound by the original agreement and requested a hearing.

Upholding MSHA's position, the administrative law judge said in the decision that the $5,000 penalty was appropriate. Island Creek appealed to the Interior Dept.'s Board of Mine Operations Appeals but the case was handed over to the Federal Mine Safety and Health Review Commission following passage of the 1977 Act. The Commission agreed with the administrative law judge's decision, saying that civil penalty regulations were not intended to bind MSHA to an assessments agreement "which was entered into on the basis of a good faith mistake that became known to all parties prior to payment."

The Commission also rejected the argument by Island Creek that the $5,000 penalty was too high. The administrative law judge had considered all six statutory criteria and did not err in assessing the penalty, the Commission's decision read. The Commission affirmed the administrative law judge's decision.

Secretary of Labor and Timothy P. Scott v. Consolidation Coal Co., FMSHRC Docket No. LAKE 80-78-D, decided May 5, 1980, final order June 16, 1980.

Shortly before MSHA inspectors arrived on the property for an inspection, a miners' representative was told to do a job that day for which he would be paid at a rate higher than the rate of pay for his regular job. When the MSHA inspectors appeared, however, the miners' representative accompanied them on an inspection that day and on the two following days. The company compensated the miner at his regular rate of pay, not at the rate of pay for the job which he would have done had he not accompanied the inspectors.

On behalf of the miner, MSHA filed a complaint alleging discrimination under Section 105(c) of the 1977 Act, saying that the company had not adequately compensated the miners' representative for his participation in the inspection. The administrative law judge said that the miner would have received a higher rate of pay had not the inspection occurred and that the company had unfairly penalized him for exercising his rights under the Act. The judge added that since the company had acted in the good faith belief that it was compensating the miner at the appropriate rate of pay, the penalty assessed would be nominal.

Secretary of Labor v. Frank J. Bough, FMSHRC Docket No. VINC 79-247-P, and Secretary of Labor v. Peabody Coal Co., FMSHRC Docket No. LAKE 79-91, decided July 15, 1980.

An MSHA inspector testified that he had observed an underground coal miner who had a lit cigarette in his mouth while operating a loading machine about 15 feet away. When the miner was searched about 30 minutes later for smoking materials, none were found and the miner denied that he had been smoking. The mine inspector was the only witness.

In his decision, the administrative law judge said that since the miner and the inspector were, in fact, friends, and since the inspector would have no motive to make a false charge against the miner, the inspector's testimony was more credible. The judge also said that the lack of physical evidence was not significant in that the inspector saw the miner duck down in the cab of the loader where he could have dropped the cigarette on the ground and trammed over it several times. The administrative law judge assesses the miner the maximum penalty of $250 under Section 110(g) of the Act.

The Secretary also argued that the company was liable for the violation because the company's program to prevent smoking underground had been insufficient. The administrative law judge ruled that the evidence failed to show that the company had maintained an adequate smoking prevention program, and he imposed a $1,500 penalty.

News and Notes

Busy Day in Dallas

Lisbon Mine Team Wins Top Honors In Rescue Contest

It was a long day at Big D Mine.

For the 33 teams entered in the National Metal and Nonmetal Mine Rescue Contest in Dallas August 28, there was no time for basking in the Texas sun. The first teams through the five 82- by 192-foot simulated mines on the Dallas Convention Center floor faced hours of uncertainty, knowing that no matter how well they had performed, another team might be faster or more efficient. On the other hand, later teams faced day-long boredom in isolation, monitored by contest officials who relented not even to let them visit the restroom alone.

For one team in particular, however, the trying day and the gruelling hours of preparation preceding it were worthwhile. The Rio Algom Corp., Lisbon Mine team from Moab, Utah, was awarded the first-place trophy with a score only six points from perfect.

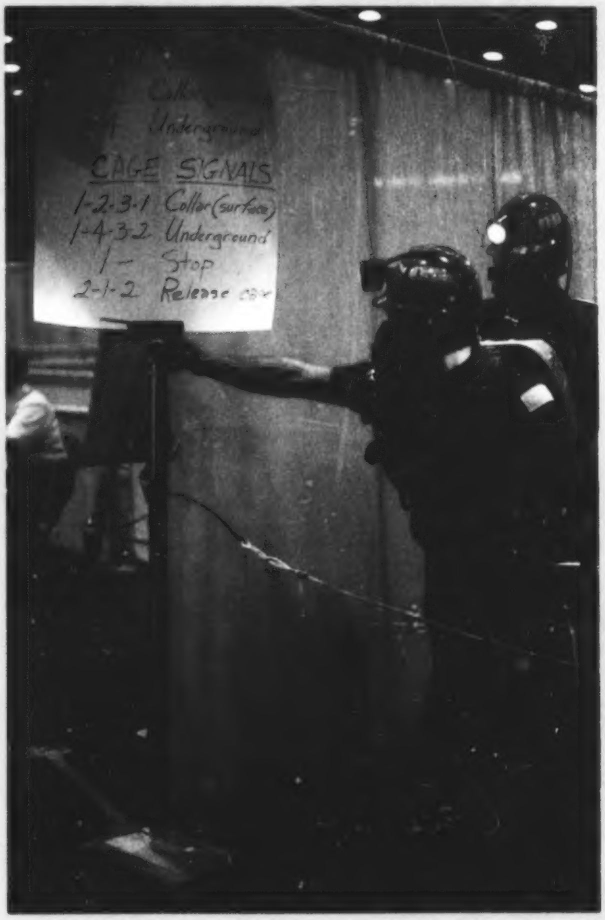
The contest—sponsored biennially by the Mine Safety and Health Administration (MSHA), in cooperation with state inspection agencies, organized labor and mine management, and other groups concerned with mine safety—is an effort to assure that teams will be well trained in proper rescue procedures and ready to render assistance in case of a real mine emergency. It was the third such contest held exclusively for metal and nonmetal mine rescue teams.

"The most important thing to us is to make everyone understand what mine rescue really is. In contests, we're not training for a trophy, we're training for an emergency," Bill Francom, trainer for the winning team, said. "Contests are important because without them, I don't think we would have the incentive or desire to train as we do now."

Mine rescue training is not easy. Many teams practice two to four hours a day in full gear in the weeks before the national contest. Some also conduct underground training sessions to create more realistic circumstances.

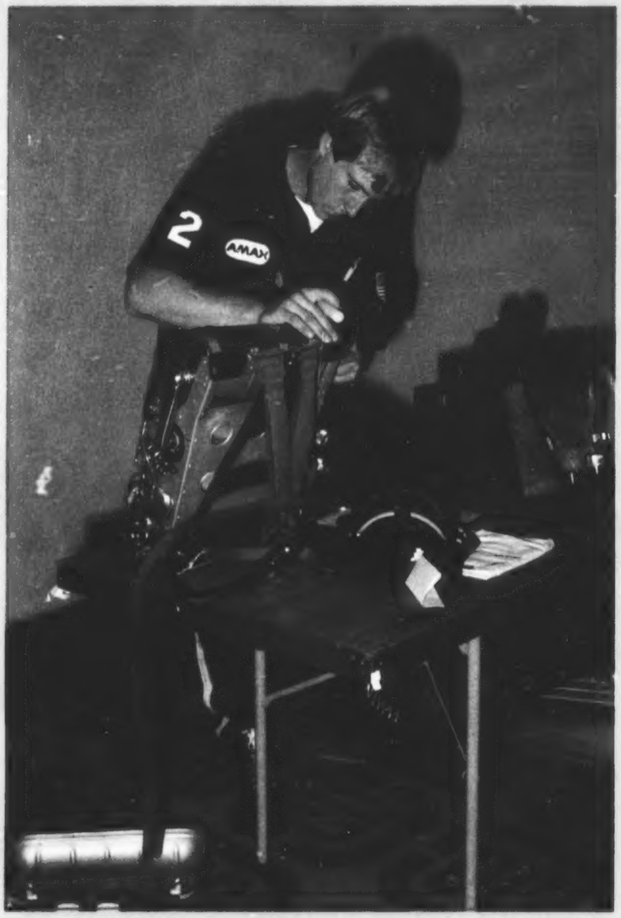
"We trained 16 four-hour sessions for the spring regional contest, and 12 four-hour sessions for the national contest. It's hard, hard work," Leo Bradshaw, trainer for Cominco American Inc., this year's ninth-place team, said. "We put them through every situation we can dream up. The contest is a snap compared to the training."

The five-person teams, wearing self-contained breathing apparatus and face masks, were judged on their performance of a practical mine rescue problem which, to the extent possible, represented the conditions a team would encounter during an actual mine fire or other mine emergency. This year, among the problems each team had to contend with were a smouldering fire, loose rib, deep water and rescue of an unconscious miner. They were instructed to safely explore all accessible parts of Big D Mine until the five missing miners were accounted for.



A member of this year's winning team, Rio Algom Corp., Lisbon Mine, rings shaft signals as the team "descends" into the mine to begin the problem.

The map man for FMC Corp.'s White Team notes mine conditions during the problem. The Green River, Wyo., team finished seventh in the competition.



An Amax Inc., Henderson Mine team member from Empire, Colo., works a problem during the Benchman competition. A team's benchman is responsible for the check and repair of vital mine rescue equipment.

International Salt Co.'s Restof Mine Team Number 1 from Restof, N.Y., checks gas testing instruments at the fresh-air base before the clock starts.

In addition to their "underground" and "surface" activities, the teams were judged on their preparation of a map showing the condition of the mine during the simulated emergency, including such notations as location of ventilation shafts and casualties. Also part of the competition was a written examination completed in privacy by each team member. Gas boxes were set up outside the convention center for the teams' testing of carbon monoxide, methane, nitrogen dioxide and oxygen deficiency.

According to Contest Director Mike Johnson, the make-or-break point of this year's problem occurred when the teams either built or failed to build a barricade before pumping water which reached the mine roof. Pumping the water before building a barricade changed the ventilation, costing a 10-point discount.

"There was no one correct way to solve the problem, but we expected most teams to build the barricade, pump the water, go in and explore, then build a temporary stopping to airlock their way out," Johnson said. Rio Algom, however, explored the remainder of the mine first, then returned to build the barricade and pump the water. Since by that time they knew the conditions of the rest of the mine, they were not required to airlock their way out.

"They got a six-point discount for failing to explore systematically, but because they solved the problem correctly and speedily, they won," Johnson added.

According to Contest Secretary J. D. Pitts, 27 of the 33 teams received the same 10-point discount for failing to build a stopping before pumping the water. Furthermore, any of 17 teams would have been eligible for first place, if not for the same 10-point error.

Obviously, the competition was close. Some teams completed the problem with perfect scores, only to be docked for exceeding the average time. Although the most important aspect of mine rescue work is to perform correctly and carefully, time is a consideration, Johnson explained, because it is the only form of pressure possible in a contest situation.

"How do you duplicate an actual mine emergency? You can't. There are no lives in danger. But by keeping the

News and Notes

Under the simulated condition, an International Salt Co. Restof Mine Team Number 1 member builds a stopping as quickly and efficiently as possible before continuing the exploration of the "Big D Mine."

The captain of Morton Salt Co.'s Weeks Island Team Number 1 checks the condition of a victim before putting him on a stretcher for transportation to the fresh-air base.

teams under the clock we can see if they are going to make mistakes because they're worried or hurried," he said.

MSHA awarded trophies to the winners of the Benchman Contest, a separate competition which tested the ability of each team's benchman to properly check and repair vital rescue equipment. Winner of the Draeger breathing device testing was Alan M. Hermel, Anaconda Copper Co., Carr Fork Mine, Tooele, Utah; and winner of the McCAA breathing apparatus competition was Rodney Philbrick, Union Carbide Corp., Pine Creek Mine, Bishop, Calif.

Aside from being the largest ever held for metal and nonmetal teams, this year's contest was more responsive to the mining industry's wants and needs. Industry requested better isolation for the teams, privacy for the written tests, and consistency among judging, and MSHA did its best to comply.

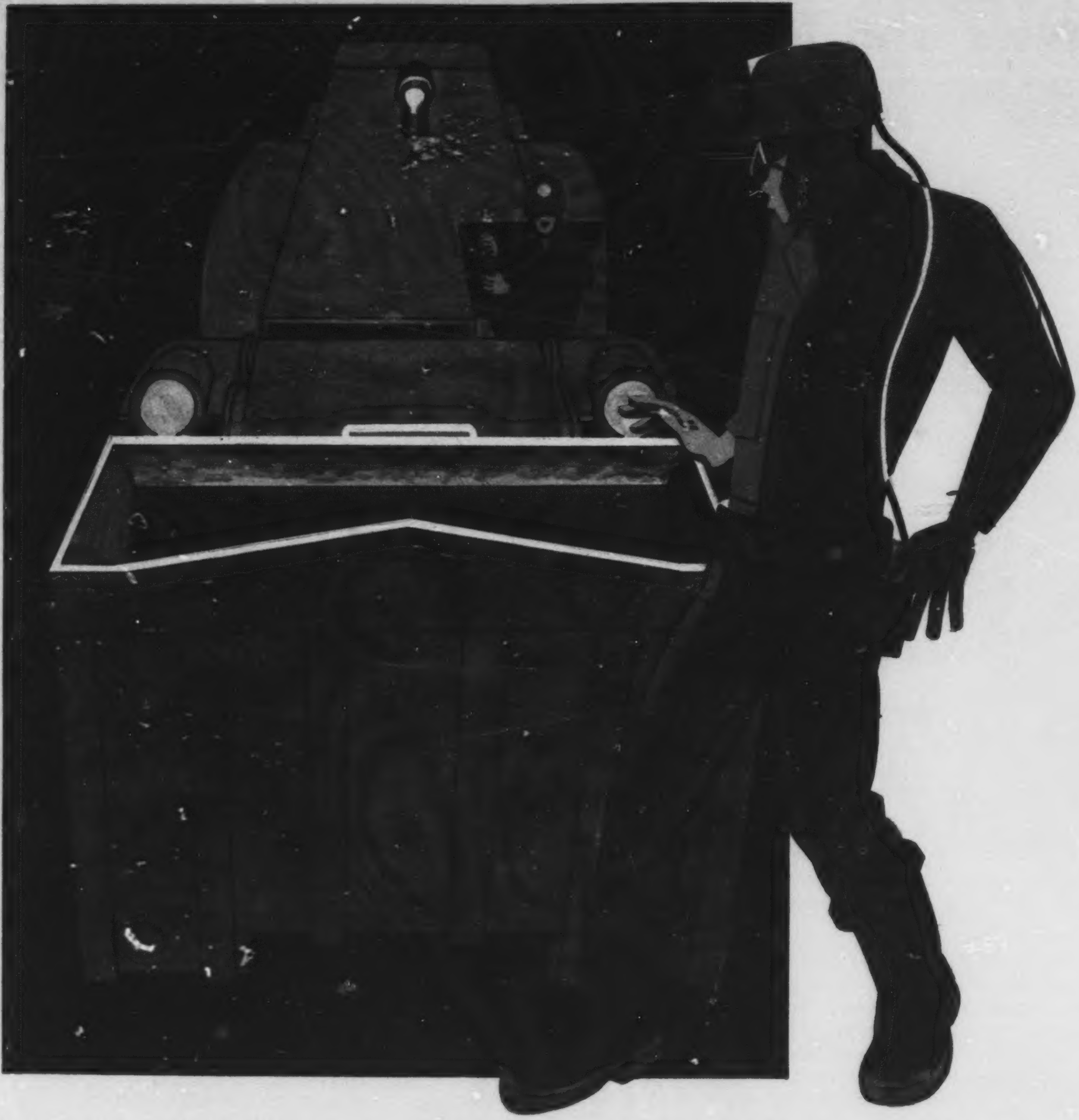
"Achieving consistency in judging was the most difficult, but we did it by beefing up the scorecard review. We used a pyramid structure, and in the end the same judge looked at every card," Johnson said. "We attempted to show that this isn't MSHA's contest. It is industry's contest."

This year's top teams were:

1. Rio Algom Corp., Lisbon Mine, Moab, Utah
2. Cities Service Co., Copperhill, Tenn.
3. Stauffer Chemical Co., Big Island Mine, White Team, Green River, Wyo.
4. Union Carbide Corp., Pine Creek Mine, Bishop, Calif.
5. Diamond Crystal Salt Co., Jefferson Island Mine, New Iberia, La.
6. Cotter Corp., Schwartzwalder Mine, Team #1, Golden, Colo.

(continued on p. 27)

The poster on the following page is designed to encourage miners to observe and work toward improved safety practices. The poster, which was created by Art Director Columbus P. Knox, can be cut out of this issue and placed on bulletin boards or at other locations regularly passed by working miners.



STAY CLEAR OF MOVING EQUIPMENT

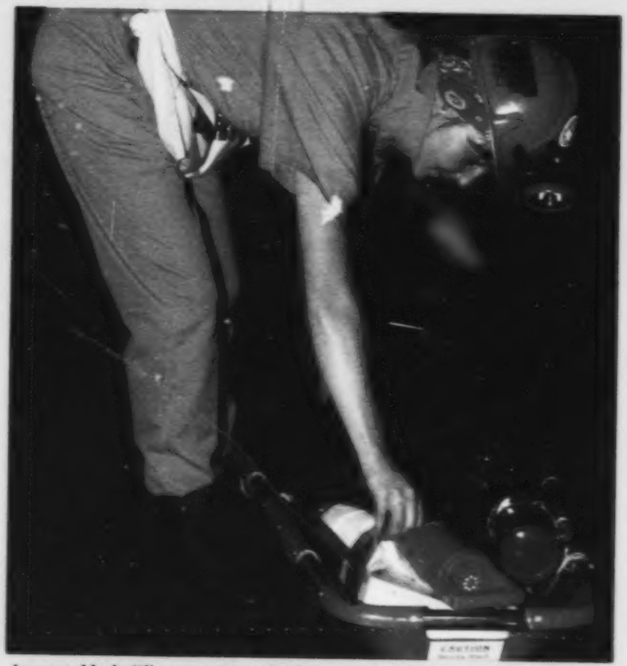
Focus

Mine Rescue Contest

(continued from p. 25)

In addition to the first place trophy, the winning team received a Congressional Medallion; the Assistant Secretary for Mine Safety and Health traveling trophy; the National Mine Rescue Association traveling trophy; wristwatches from the United Steelworkers of America; a Draeger award; and a $5,000 scholarship awarded by Ansul Company.

"This year's mine set up was better than last year's, and it was a more thought-provoking problem than usual," John Vice, Diamond Crystal Salt Co.'s team captain, said. "These contests are good training. Also, they get everyone together so we can see how other teams operate. Contests keep the mine rescue spirit going . . . you never know when you'll need it."—D.H.



Jeanne McAuliffe, member of Climax Molybdenum Co.'s Climax Mine team from Leadville, Colo., checks mine rescue gear at the fresh-air base.

Upcoming Meetings

November

12-14 Colorado School of Mines, Mine Safety and Health Administration, United States Bureau of Mines, Colorado Mining Association, and Colorado Safety Association, short conference, Sixth Institute on Mine Safety and Health, (Fee $120), Green Center, Golden, Colo. Contact H. W. Emrick, Director of Continuing Education, Colorado School of Mines, Golden, Colo. 80401

December

8-12 Mine Safety and Health Administration, short course, Coal Mine Ventilation, National Mine Health and Safety Academy, Beckley, W. Va. Contact Fran Rhodes, The Academy, Box 1166, Beckley, W. Va. 25801

Recent Additions to the MSHA Library

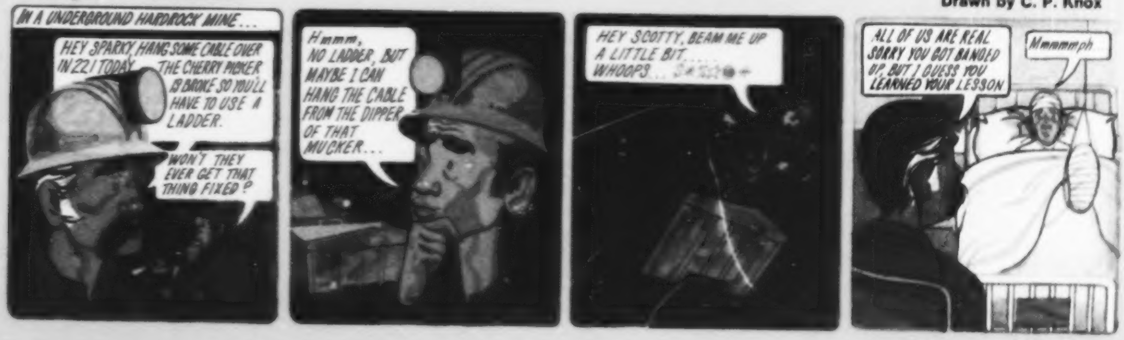
- **IR 1118—Evaluation of Two Light-Scattering Respirable Dust Monitors,** by E. M. Thompson, H. N. Treaftis, T. F. Tomb, and A. J. Beckert II, 14 pp., 1 Table, 10 Figs.

This report describes the evaluation of two respirable dust sampling instruments that use the principle of light-scattering to measure the mass concentration of an aerosol. One instrument was developed in West Germany at the mining research establishment of the Steinkohlbergbauverein. Comparative measurements were obtained with the two instruments and also with approved coal mine respirable dust samplers in several underground coal mines and in the laboratory using aerosols of coal, limestone, silica and Arizona road dusts. The report discusses the results of these comparative measurements and the applicability of the instruments for assessing coal mine environments.

- **IR 1120—Comparison of Surface Coal Mine Respirable Dust Concentrations Measured With MRE and Personal Gravimetric Sampling Equipment,** by J. J. Alvarez, T. F. Tomb, R. R. Gadomski, and J. L. Custer, 10 pp., 3 Tables, 2 Figs.

Lumps 'N' Chunks

Drawn by C. P. Knox


IN A UNDERGROUND HARDROCK MINE...
HEY SPARKY, HANG SOME CABLE OVER IN 221 TODAY. THE CHERRY PICKER IS BROKE SO YOU'LL HAVE TO USE A LADDER.
WON'T THEY EVER GET THAT THING FIXED?
Hmmm, NO LADDER, BUT MAYBE I CAN HANG THE CABLE FROM THE DIPPER OF THAT MUCKER...
HEY SCOTTY, BEAM ME UP A LITTLE BIT...... WHOOPS...
ALL OF US ARE REAL SORRY YOU GOT BANGED UP, BUT I GUESS YOU LEARNED YOUR LESSON
Mmmmmph...

Safety Technolgy

Coal mine respirable dust concentrations that are measured with approved respirable dust sampling equipment are converted to equivalent concentrations as determined with the MRE dust sampler in order to determine compliance with the respirable dust standard. The conversion factor, 1.38, was originally determined from comparison measurements made in underground coal mine environments.

This report describes the results of MSHA sampling at surface mining operations to determine if 1.38 is a valid factor for converting surface coal mine dust concentrations measured with approved personal samplers to equivalent MRE concentrations. The conversion factor determined by comparing samples taken with the two kinds of instruments at surface coal mines was within 9 percent of the factor derived from underground measurements. The report concludes that the 1.38 conversion factor should continue to be used for converting all coal mine respirable dust measurements taken with approved personal samplers.

- **Mine Injuries and Worktime, Quarterly, Closeout Edition,** 1979, 18 pp., 4 Tables, 1 Fig.

The new closeout edition of this quarterly publication briefly summarizes final data on injuries and worktime for all U.S. mining industries in 1979. Following the same format as the regular quarterly editions, it supersedes the January-December, 1979, issue, which gave preliminary data for the full year. The closeout edition will be published as a fifth issue of the quarterly each year in the future.

Films

1. Surface Blasting in Metal and Nonmetal Mines (Film No. 873)

Here's How to Obtain Reports and Films

Reports and Films

Single copies of Information Reports are available through:

MSHA, Office of Information
4015 Wilson Blvd., Rm. 1237-A
Ballston Tower No. 3
Arlington, Va. 22203

Films can be borrowed from the National Distribution Center in Pittsburgh, Pa. Send all requests to:

Motion Pictures
MSHA
4800 Forbes Ave.
Pittsburgh, Pa. 15213

Films can be purchased by directing requests to:

Chief, Division of Audio Visual Services
MSHA, Education and Training
4800 Forbes Ave.
Pittsburgh, Pa. 15213

Stamp of Approval

The following equipment has been recently added to the Mine Safety and Health Administration's list of permissible or approved equipment.

- **Model PE45, 7.5 volt, battery-powered, green label radio,** issued to General Electric Co., Mobile Radio Department, Lynchburg, Va.;
- **Model No. LM105, 12 volt, battery-powered, five-minute page detector,** issued to Comtrol Corp., Irwin, Pa.;
- **Type 5012 drum miner,** 550 volt, 3 phase, 60 hertz, alternating current, with two 200 hp, 550 volt, 3 phase, 60 hertz, AC cutter head motors; one 50 hp, 550 volt, 3 phase, 60 hertz, AC gathering head motors, and two 7.5-60 hp, 550 volt, 3 phase, 60 hertz, AC tram motors, issued to National Mine Service Co., Ashland, Ky.;
- **Model 10SC22-D shuttle car,** 440/550 volt, 3 phase, 60 hertz, alternating current, with one conveyor motor, 25 or 30 hp, one pump motor, 10 or 15 hp, 440/550 volt, AC and two traction motors, 30 or 35 hp, 250 volt, DC, issued to Joy Manufacturing Co., Franklin, Pa.;
- **Model CD-41A, roof bolter,** 440 volt, 3 phase, 60 hertz, alternating current, with one 50 hp motor, issued to United States Steel Corp., East Carbon, Utah;
- **Model 82 AC scoop,** 460 volt, 3 phase, 60 hertz, alternating current, with one 75 hp, 460 volt, AC motor, issued to In-Pro Corp., Damascus, Va.;
- **Longwall mining system,** 950 volt, 3 phase, 60 hertz, alternating current, with one 400 hp, three 175 hp, one 125 hp, and two 75 hp, 950 VAC motors, issued to Mining Progress, Charleston, W.Va.;
- **Model 935 LSH diesel-powered loader,** issued to Eimco Elkhorn, Monroe, N.C.;
- **Models 980T20 and 920T27 diesel-powered mining truck,** issued to Eimco Mining Machinery Co., Salt Lake City, Utah;
- **Model 918 LHD, diesel-powered loader,** issued to Eimco Mining Machinery Co,. Salt Lake City, Utah;
- **Model P/N 468697 type C continuous flow class supplied air respirator,** issued to Mine Safety Appliances Co., Pittsburgh, Pa.;
- **Models 04400 and 04401 continuous flow class supplied-air respirators,** issued to Clemco Industries, San Francisco, Ca.;
- **Models 10018, 10246, 10192, and 10279 half mask respirators,** issued to Pulmosan Safety Equipment Corp., Flushing, N.Y.;
- **Models 10033, 10207, 10258, and 10291 half mask respirators,** issued to Pulmosan Safety Equipment Corp., Flushing, N.Y.;
- **Caricoal Coalseal Conveyor Belt,** issued to B. F. Goodrich Co., Engineered Products Group, Akron, Ohio;
- **Compound Number 320, for use as cover on hydraulic hose,** issued to Electric Hose and Rubber Co., Ocala, Fla.;
- **Fairmont Fiberglass Tubing, for use as ventilation duct,** issued to Fairmont Fiberglass Tubing, Barrackville, W.Va.;
- **Aquacent Heavy (water-in-oil) Emulsion 40/60,** issued to Century Hulburt Inc., Philadelphia, Pa.;
- **Phosphate Ester NTP (trianryl phosphate ester),** issued to Century Hulburt Inc., Philadelphia, Pa.;
- **Solcenic 2 (concentrate) to be diluted with water,** issued to Century Hulburt Inc., Philadelphia, Pa.;
- **Solcenic 3-A (concentrate) to be diluted with water,** issued to Century Hulburt, Inc., Philadelphia, Pa.;
- **Solcenic 7 (concentrate) to be diluted with water,** issued to Century Hulburt, Inc., Philadelphia, Pa.;
- **Model No. SNN, 3 volt, battery-powered, tape recorder,** issued to Nagra Magnetic Recorders Inc., Cleveland, Ohio;
- **Longwall mining system,** 480/950 volt, 3 phase, 60 hertz, alternating current, with (3) 175 hp, (3) 125 hp, (2) 75 hp, and (2) 30 hp motors, issued to Mining Progress Inc., Charleston, W.Va.;

COAL INDUSTRY EMPLOYMENT BY SIZE OF OPERATION

Fiscal Year 1979

EMPLOYMENT (Thousands)	MINE SIZE (Employees)	NUMBER OF MINES
	UNDERGROUND	
21,346	1-49	1,420
10,861	50-99	161
10,772	100-149	88
89,484	150 or more	256
	SURFACE	
27,515	1-49	2,144
6,851	50-99	102
6,620	100-149	55
24,097	150 or more	86
	OTHER SURFACE FACILITIES	
21,589	——	1,333

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